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THE ROLE OF SEED PRODUCER AND MARKETING COOPERATIVES ON WHEAT CROP PRODUCTION AND ITS IMPLICATION TO FOOD SECURITY

(THE CASE OF ENDAMOKHONI WEREDA, TIGRAY, ETHIOPIA)

By

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DECLARATION

This is to certify that this Thesis entitled **"Role of Seed Producers and Marketing Cooperative on wheat crop production and Its Implication to Food Security (Endamokoni Woreda, Tigray, Ethiopia)"** Submitted in partial fulfillment of the requirement for the award of degree of MSc in Development Policy Analysis to the college of Business and Economics, Mekelle University, through the Department of Economics, done by Mr. Sintayoh Getachew I.D No CBE/PE/237/03 is an authentic work carried out by him under my guidance. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

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ABSTRACT

Ethiopian agriculture is largely small scale subsistence oriented and crucially dependent on rainfall. Increasing the production and productivity of the crop sub sector is one of the measures taken in Ethiopia to assure food security. This improvement can only be realized if modern technologies are utilized; among the most modern technologies seed take the first priority due to its nature. However, the low capacity of Government Company, sluggish growth of the private sector in the seed industry and the nature of the demand of subsistent farmers obliged to seek for another alternative seed source. The establishment of seed producer and marketing cooperative is an essential area to be coordinated for obtaining the seed on time.

The participation of farmers in the Seed production and marketing cooperatives is constrained by various facts, farm characteristics, socio-economic and institutional factors. Hence to evaluate their role and identify most influencing factors of Seed producer and marketing cooperatives in Tigray region one Seed producer and marketing cooperatives was considered Hiryti MekanSPC. Primary and secondary data were employed in this research mainly primary data were used from interview result of 160 selected farmers from 3Kebeles Endamokoni Woreda.

Both descriptive and econometric data analysis techniques were applied. In the econometric analysis the role of seed producer and marketing cooperatives on wheat crop production and its implication to food security is analyzed using the Heckman two-stage procedures and Greer and Thorbecke measuring food poverty(FGT). To see the seed marketing system of the SPC we use Focus discussion.

Out come of the Heckman two stage analysis reveals , the treated group households possess on average more than the controlled group households by Birr 1637.48 per year. In the first stage of the Heckman two-step procedure the variables that are found to determine participation in using seed from SPC five. After the selectivity bias is controlled by the model in the second stage the seven variables were found to have significantly determined household wheat crop production.

The descriptive statistics revealed that 93.43 percent of the participants in using seed from SPC and 85.72 percent of non participants in using seed from SPC are found to be food secure while 6.57 percent of the users and 14.28 percent of the non users found to be food insecure.

Hiryti-Mekan SPC is farmers' cooperative main purpose is to ensure timely delivery of production inputs, i.e. seed. The main marketing systems of Hiryti-Mekan SPC are in two ways, to accept and to sell seeds from members, farmers or other agencies. But, this study found out that the marketing system is still obstructed by logical, technical, and ideological constraints. Thus, The cooperatives should take actions by building their capacity especially in the areas of technical personnel, offices, warehouse and machineries, diversification of service delivery, participation in social affairs, consistent/regular and sufficient delivery of dividend/returns and improving the awareness of members through education, enabling to production.

Key words: *wheat crop production, Hiryti-Mekan SPC, Heckman, Endamokoni.*

DEDICATION

I dedicated this thesis manuscript to my late hero, leader and prime minister Meles Zenawi, and to my beloved brothers and sister

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ACRONYM

ADLI	Agricultural Development-Led Industrialization
BoPF	Bureau of plan and finance
CBSB	community based seed bank
CI	Condition Index
CSA	central statistic agency
DA	Development Agent
DCI	Direct Calorie Intake
DID	Difference in Difference
EARI	Ethiopian Agricultural Research Institute
ESE	Ethiopian seed Enterprise
ESTA	Ethiopian Seed Trade Association
FAO	Food and Agriculture organozation
FCU	Farmers' Cooperative Unions
FEI	Approach and the Food Energy Intake
GDP	Goss Domestic product
GTP	Growth and Transformation Plan
HMSPC	Hiryti-Mekan Seed Producer Cooperative
HRC	Holetta Research Center
HYVS	High yield variety seed
ILO	International Labor organization
ISSD	Integrated Seed Sector Development
IV	Instrumental Variables
LSB	Local Seed Businesses
MOARD	Minster of Agriculture and Rural Development
MoFED	Minster of finance and Economic Development
MU	Mekelle university
NGO	Non Government organization
NSC	National seed council
NSIA	National Seed Industry Agency
OoARD	Office of Agricultural and Rural Development
OLS	Ordinary Least Square
PASDEP	Plan for Accelerated and Sustainable Development to Eradicate Poverty
PSM	Prosperity Score Matching
REST	Relief Society of Tigray
SPC	Seed producers cooperative
SPMC	Seed producers and marketing cooperative
TARI	Tigray Agriculture Research institute
TLU	Tropical Livestock Unit
VIF	variance inflation factors
WoARD	woreda office of Agriculture and Rural Development

TABLE OF CONTENTS

LIST OF TABLES

Chapter one
1. INTRODUCTION

1.1 Background and Justification of the study

Ethiopia comprises an estimated area of 112 million hectares, of which 65 percent is suitable for some form of agriculture (MoFED, 2007). The agriculture sector is the principal engine of growth of the Ethiopian Economy employs 83% of the labor force, contributes about 90% of the export and 41% of Gross Domestic Product (GDP), and provides about 70% of the county's raw material requirement for large and medium scale industries (MoFED, 2011).

The country has a good agricultural potential which has not yet been used appropriately. Ethiopia's agriculture is highly dependent on the vagaries of nature, especially the availability of rain fall. Even if the country is said to have high irrigation potential, only less than 5 percent of it is used (Ashenafi, 2008). Out of the total production of agriculture, about 70 percent are crop production and the remain (30%) are from the livestock sub-sector (CSA, 2007). Out of the total temporary and permanent crops produced in the country, more than 85 percent comes from three major food crops; cereals, pulses and oilseeds.

Seed is a key input for improving crop production and productivity. Increasing the quality of seeds can increase the yield potential of the crop by significant folds. Seed is one of the most economical and efficient inputs to agricultural development (FAO, 2006). To act seed as a catalyst in agricultural transformation improved seed has to be always supplied. However improved seed should be made available to a broad base of farmers on continuing base if farmers are expected to be efficient in terms of what and how they produced. But the current practice indicates that most farmers do not have access to commercially processed seed at a nearby retail outlet though many released varieties have never been widely disseminated (Rohrbach *et al.*, 2002). This led to the increasing of imbalances between the seed demand and supply. Pertinent to this MOARD 2010 noted, the total annual seed requirement by the agricultural sector in Ethiopia was estimated at about 700,000 tones. During 2011, about 15 percent of this was met by the formal sector, distributing over 105,000 tones of improved seeds which is not sufficient for the demand of the sector, indicates that the informal seed marketing is still the dominant system for seed supply.

According to National seed council (NSC) as cited in Abdisa..2008, In Ethiopia, many farmers in marginal environment have no access to good quality seed. This key constraint hampers agricultural productivity. To solve these constraints the federal and regional governments are applying different

efforts but limitations related to the variety of stakeholders, farmers, cooperatives, entrepreneurs, agro-input suppliers and others are still hindering facts, which effect to the continuous growing of the gap between seed demand and supply.. As a panacea embellishment of local seed business found as necessary and in Tigrai regional state there are different LSB centers established and are operating as pilot project.

The establishment of Local Seed Businesses is found to be an effective pathway to strengthen the link between the informal and formal seed systems and thereby contribute to seed guarantee, which enhances food security and in return rural economic development in Ethiopia is expected to show progresses. The project is considered vital in enforcing seed supply and promoting the entrepreneur-ship of farmers' communities. It is currently operating in Tigray region with six innovation sites.[1] Through the support of MU programe on participatory basis barley breeding farmers were able to increase access to preferred genotypes. They also get technical helps in the production aspects: such as farm management, variety selection, harvesting and post harvesting. However they lack the necessary skill and knowledge that enable them to operate and market their seed production independently. Farmers at almost all of the sites have a good local market for the seeds they are producing. But this is not created using business and marketing principles (LSB 2010).

In Endamehoni district both the informal and formal seed systems are functional. The formal seed system is dominant for crops like wheat, field pea and faba bean, as the agro-ecology[2] is highly suitable for these crops and high demand exists for seeds. The area has relatively dependable rainfall and the ESE and the OoARD (Office of Agricultural and Rural Development) have experience with farmer-based seed production, so that the site could serve as a seed source to the neighboring Tabias and woredas.

Cooperatives and unions had -also played a major role in seed, fertilizer and pesticides distribution and marketing in the sense that they would have more number of marketing outlets in remote rural areas than the already known companies in this regard. This presumption is more number of distribution and marketing outlets for cooperatives would solve the lack of demand-supply determination in the use of agricultural inputs and the carry-over that the companies are currently facing.

Consequently, Cooperatives are increasingly being presented as one of the pre-condition for a successful drive against poverty and exclusion (ILO, 2003). Cooperatives have a long history in Ethiopia, particularly in the form of traditional collective action organizations, such as work groups

[1] The sites include Endamehoni woreda, Tabias Mekan, Simret, Tahtay haya and shigomayo……

[2] its agro eologyy, is dega, and weynadega

(*jiges, wonfels, debos*), rotating savings and credit associations (*iquobs*), and burial societies (*idirs*), which are still very much present (Bernard et al, 2010).

The establishment of seed producer and marketing cooperative is a new concept but it is an essential area to be coordinated for obtaining the seed on time. Hiryti-Mekan SPC is a seed producer and marketing cooperative which is established with above 60 members. The cooperative is also not only an agency for supplying seeds but also teaches the members the appropriate usage of seeds. It is believed that establishment of this cooperative is solving the dated back seed marketing and seed availability and seed safty. Hence, the paper aims at identifying the major reasons behind the very low number of participants in the cooperative and measuring the participants' wheat productivity.

1.2. Statement of the Problem

Tigray Region, in the northern highlands of Ethiopia, is known for a long history of crop cultivation under diverse geographic, climatic, and socio-cultural conditions. The region represents one of Ethiopia's semi-arid grain producing areas. The seed demand in Tigray is very high because farmers are mainly crop producers. However, the seed supply is always lagging behind the demand which led to the limited availability of seed and so is crop production, which is less in terms of its quality and also quantity. To address the problem of excess seed demand there are many e informal seed producers and are operating for many years, which is from farmer to farmer. Nevertheless, the formal seed system has been less successful in supplying adapted varieties and quality seed. The estimates for the percentage of farmers who purchase seed produced from the formal system ranges from 5% to 10 % (Ibrahim and Fetien2010. The remaining demand has been supplied by the informal seed supply system for the past many years of years, which is considered illegal by the country seed laws (Louwaars, 2009 as cited in Getachew 2010). This condition creates uncreative limitations and hinders the informal system not to flourish in the seed market. As a result, the farmers, farmer owned cooperatives, and entrepreneurs are not stimulated to enter into the seed business.(Getachew 2010). A dominant perception continues to exist that the informal seed system is "low-tech"; it is considered the result of a delay in farmers' adoption of certified hybrid maize or improved wheat variety seed. (LSB 2010)

Scholars have indicated that cooperatives could play a very crucial role in varies socioeconomic development areas if they operate in accordance to the universally accepted cooperative organizing principles and core values. For instance, (Alan 1984 as cited in Alemu 2011) argued that cooperative link is important for several reasons such as developing high social capital, reduce labor mobility, and in utilization of indigenous resources such as local capital for local development.

Formation of seed marketing cooperatives points out two major reasons: solve market failures and to address distortions in the supply chain (Nimble, 2005). Furthermore, Nimble (2005) stated that the need for formation of agricultural marketing cooperatives lies on the elimination of middle person (unnecessary profits in trade and commerce) and promotion of socio-economic well-being of their members, in the long run, among the people.

Taking the findings of these scholars, which was complemented by various monitoring and evaluation regarding seed the government of Ethiopia gave due regard to the matter and several initiatives was made so as to improve the seed production and distribution, LSB projects were established as a result of the initiatives made by Local seed business project / Integrated Seed Sector Development 34 seed producer and marketing cooperatives are being established in Ethiopia, from those cooperatives six of them are in Tigray region state. Seed producers and marketing cooperatives are among these organizations which operate with the intention to increase crop production, ensure food security, accelerate rural development and reduce poverty(LSB 2007). Among those which were established in different woredas of the region, they were established with the interest of their members and they also get technical helps in the production aspects from LSB project According to kiros 2009 the informal seed system has gone largely unrecognized, unappreciated and undocumented while the formal seed sector has been unsuccessful in meeting farmers' needs. Various factors may hinder the efficiency of seed producer and marketing cooperative in Ethiopia.

Nevertheless, even though high attention has been given to them and multiple support are provide for the LSBC to enable them produce sufficient amount of seed in terms of both (quality and quantity) still they have observed that they are not operating up to the expected level. In addition they lack proper understanding about the production and the preference of the farmers who demand the seed. Related to this (UN, 2009:6) paraphrase, Cooperatives have also been viewed as state instrumentalities or parastatals, and as being less concerned about the genuine needs of their members. Most of the cooperatives involved in seed production and marketing they have many challenges in production and marketing. They are not also well equipped with the necessary capacities that enable them to operate their seed production independently and to penetrate the seed market.

Therefore, based on these realities one can ask to what extent seed producer and marketing cooperatives in Ethiopia and more specifically in Tigray Regional State have effect in crop productivity, food security and stabilizing seed marketing.

These questions were not studied in-depth; as a result the strategies designed are not promoting the local seed marketing development in a commercial way, which in turn suppresses the Economy in general. For this reason it has been remained to be difficult to utilize local seed resources. The purpose of this thesis was to fill the gap, the researcher investigated how the situation look like and analyzed different socio -economic parameters in order to examine the role of seed producer and marketing cooperative on wheat crop production and improving food security in Endamokoni woreda.

1.3. Basic Research Questions

- What roles do seed producer and marketing cooperatives play on wheat crop production this less discussed and ready to defend it and food security of the farmers?
- What are the determinants of farmers to participate in seed producer cooperatives?
- How the Hirity- Mekan seed producer and marketing cooperative's market system affect to the farmers of the woreda?

1.4. Objective of the Study

1.4.1. General Objective

The supply of seed with required quality, alternative, time and price is affected by the seed system (formal or informal). So the purpose of this study is to evaluate and analyze the role of seed producer and marketing on wheat crop production and to see its implication on food security on the specific woreda.

1.4.2. Specific Objectives

The specific objectives of the study include:

1. To assess the role of seed producer and marketing cooperatives on wheat crop production and food security in the study area.

2. To investigate and analyze the determinants of farmers not to participate on using seed from SPC.

3. To see and evaluate the seed marketing system used by Hiryti-Mekan Spc.

1.5. Significance of the Study

The recently adopted five-year Growth and Transformation Plan (GTP) (2010/11-2014/15) gives special emphasis to the role of agriculture as a major source of economic development. Following the Agricultural Development-Led Industrialization (ADLI) strategy and building on PASDEP achievements, the GTP has the priority to intensify productivity of smallholders and strongly supports the intensification of market-oriented agriculture, either at national than international level, and promotes private investments. (MoFED 2010)

To increase productivity of crops and to help food security, farmers should have access to improved seeds of the right type, at the right time, at the right place, at a reasonable price and with right-sized seed packages. But seed marketing is the weakest link in the seed production/marketing chain in Ethiopia.

To promote the seed producers and marketing contribution on crop production and the impact on food security of the farmer, studying on the role of seed producers and marketing cooperative is significant. In order to motivate, recognize and document the role of this seed producer and marketing cooperative in marketing and supply of seed to the farmers this study assessed how the seed producer and marketing cooperative is contributing to the farmers' crop productivity? What are the strategies used for the seed marketing and supply by the seed producer and marketing cooperative? What is the impact of seed producer and marketing cooperative on food security of the farmers in the woreda?

By doing this the study can provide some evidences to the policy makers of the woreda as well as the region, which could be used in their decision making process of establishing and helping seed producer and marketing cooperatives. The study also significantly contributes to the leaders of the seed producer and marketing cooperatives on their strategic plan especially in the marketing and supply of seed. In addition, the paper is also believed to contribute for the existing literature in the area and encourages to conduct further researches.

1.6. Scope of the Study

The study on the role of seed producer and marketing cooperatives on wheat crop production and its implication to food security was conducted in Tigray Regional State, Endamokoni woreda. The study considered only one keble that has seed producer and marketing cooperative (mekan) And two kebele which doesn't have seed producer and marketing cooperative but near by Mekan tabia (simret and Tahtay Haya). Based on this idea wheat seed, was selected that are commonly multiplied by farmers in the woreda. . Due to time and financial constraint, this research has been limited to only 3 *Kebeles* of the woreda.

Accordingly, technology, time and financial coverage is limited to only selected seed producer and marketing cooperative restricted to *Endamokoni* district in terms of area coverage. Even though, the results of this study can be used as a reference for other similar seed producer and marketing cooperatives studies in other areas its implication might not be the same in every where and requires careful consideration to other areas where LSB is operating

CHAPTER TWO

2. REVIEW OF LITERATURE

2.1 Definition of wheat seed and adoption

2.1.1 Definition of wheat seed

Seeds are basic agricultural input. More importantly quality seeds of any preferred varieties are basis of improved agricultural productivity since they respond to farmers needs for both their increasing productivity and crop uses (Pelmer, 2005). Currently, small scale farmers increasingly face many challenges including both biotic and abiotic and must respond to market demands. Local landraces alone do not constitute solution to all these multiples constraints. Therefore improved and formally bred varieties can contribute to meeting some of those challenges. However, their seed accessibility and availability to farmers are determined by many factors including the crop breeding systems, institutional/organizational arrangements and socio-economic conditions of farmers. (Jean Claude Rubyogo…2007**)**

In modern agriculture, seed is a vehicle to deliver almost all agriculture-based technological innovations to farmers so that they can exploit the genetic potential of new varieties. The availability, access and use of seed of adaptable modern varieties is, therefore, determinant to the efficiency and productivity of other packages (irrigation, fertilizers, pesticides) in increasing crop production to enhance food security and alleviating rural poverty in developing countries. For seed to play a catalytic role, it should reach farmers in a good quality state, i.e. high genetic purity and identity. (Zewdie 2008)

Wheat is one of the major cereals grown in Ethiopia, mainly by subsistence farmers under rain fed conditions. Smallholders cultivate 82% of the wheat area and account for 76% of wheat production (Adugna et al. 1991). Wheat area increased from 600,000 to 760,000 ha between 1979/80 and 1994/95 (CSA 1989 and CSA 1995), but the national average yield remains less than 1.5 t/ha (Hailu and Chilot 1997).Research to improve the productivity of wheat has been conducted for more than 20 years at Holetta Research Center (HRC), located in Wolmera woreda, 30-50 km west of Addis Ababa.

In general in Ethiopia and that of southern Tigray in particular Crop production is one of the mainstays of the rural population. The sector's output, however, has been very low due to biophysical and socioeconomic challenges and inadequate technological interventions, including the seed delivery system. With changes in rainfall amount and duration, cultivars that were good yielder under high or

adequate rainfall became obsolete as earliness and drought resistance traits became important. Sustained increase in agricultural production and productivity is dependent largely on the development of new and improved varieties of crops and on an efficient system for timely supply of quality seeds to farmers. However, this is clearly affected by nature of local seed system. (Kiros..2009)

2.1.2 Definition of adoption/participation

Adoption process is the change that takes place within individual with regards to an innovation from the moment that they first become aware of the innovation to the final decision to use it or not. However, as emphasized by Ray (2001), adoption does not necessarily follow the suggested stages from awareness to adoption; trial may not be always practiced by farmers to adopt new technology. Farmers may adopt the new technology by passing the trial stage. In some cases, particularly with environmental innovations, farmers may hold awareness and knowledge but because of other factors affecting the decision making process, adoption may not occur.

Dasgupta (1989) indicate that, the decision to adopt an innovation is not normally a single instantaneous act, it involves a process. The adoption is a decision-making process, in which an individual goes through a number of mental stages before making a final decision to adopt an innovation. Decision-making process is the process through which an individual passes from first knowledge of an innovation, to forming an attitude toward an innovation, to a decision to adopt or reject, to implementation of new idea, and to confirmation of the decision (Ray, 2001).

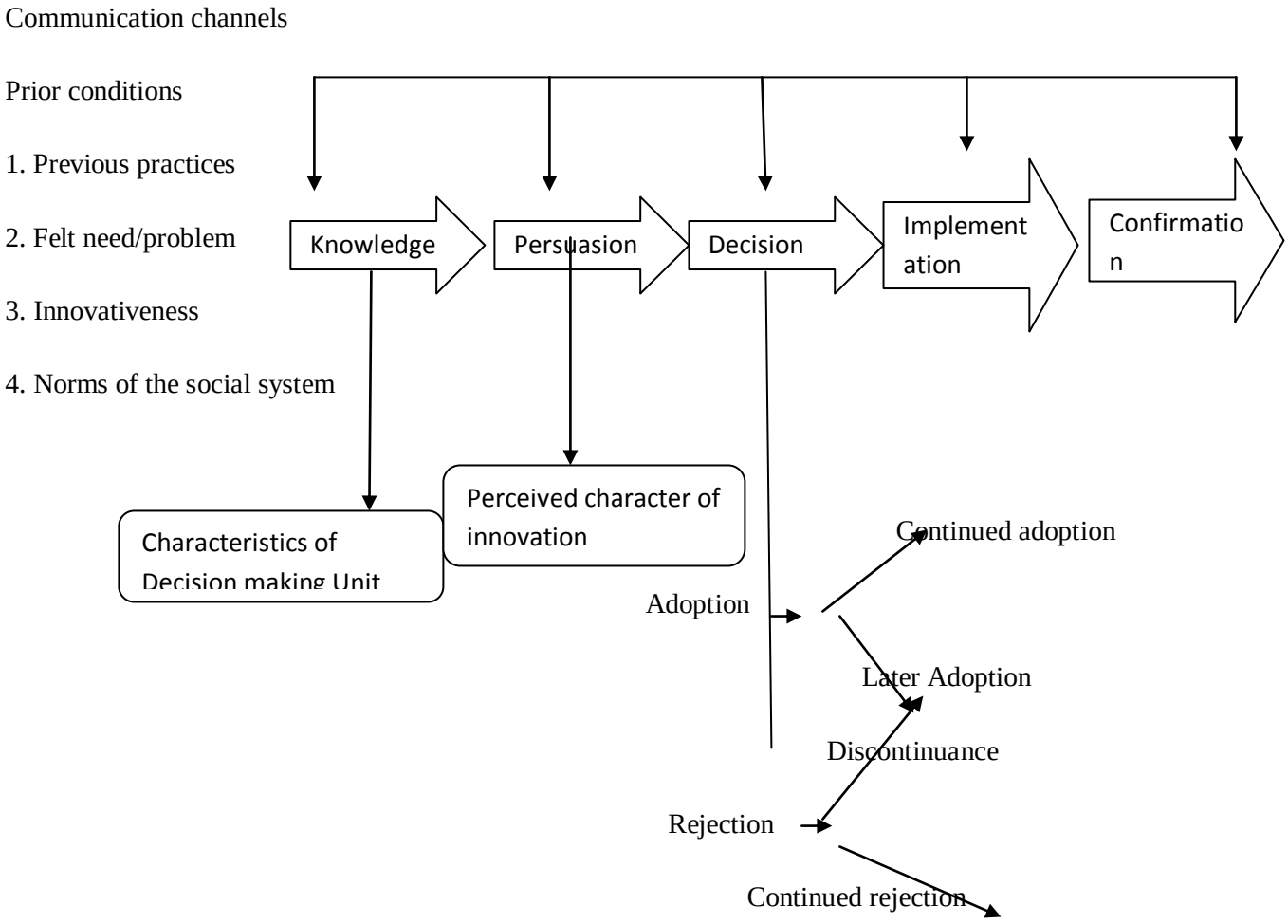
The rate of adoption is defined as the percentage of farmers who have adopted a given technology. The intensity of adoption is defined as the level of adoption of a given technology. The number of hectares planted with improved seed (also tested as the percentage of each farm planted to improved seed) or the amount of input applied per hectare will be referred to as the intensity of adoption of the respective technologies (Nkonya *et al.*, 1997).

2.1.2.1 The classical five-stage adoption process

The classical five-stage adoption process model which was formulated by the North Central Rural Sociologists Committee (1961) was the dominant model until it was modified by Rogers and Shoemaker (1971). According to Campbell (1966) the classical five –stage adoption process model was developed from the recognition that adoption of an innovation often is not an instantaneous act. Rather it is a process that develops over a period of time and influenced by a series of actions. The model composed of five stages namely awareness, interest, trial, evaluation and adoption.

2.1.2.2. The innovation decision process

Some guidelines, perhaps more useful from extension approach or strategy point of view, was evolved from propositions concerning the adoption process. The classical 5-stage concept (awareness, interest, evaluation, trial, adoption) as formulated by the North Central Rural Sociologists Committee (1961) was widely accepted in spite of valid criticism voiced, amongst others, by Campbell (1966) and later also by Rogers and Shoemaker (1971) who then designed the innovation decision process (Duvel, 1991) This model was later revised by Rogers (1983) and is presented as follows



1. Socio economic characteristics
2. Personality variable
3. Communication behavior

1. Relative advantage
2. Compatibility
3. Complexity
4. Observability
5. Trialability

Figure2.1. The Innovation Decision Process (Rogers, 1983)

The innovation decision is the process through which an individual or other decision making unit, extension organization, for example, passes from first knowledge of an innovation to forming an attitude towards the innovation, to decision to adopt or reject, to implementation of the new idea, and to the confirmation of the decision (Rogers, 1983). This model has five stages, the first being the knowledge stage in which the individual becomes exposed first to the new idea and develops some understanding of it. The second phase is persuasion, during which individuals either persuades them or is open to persuasion by others. At this stage too, an attitude towards the innovation evolves. The third stage is decision, when the farmer decides to adopt or reject the new idea. The fourth stage is implementation when the individual implements the decision he made in the previous stage. Finally, there is confirmation in which the individual continues to question the wisdom of his decision once the decision to adopt the innovation has been made.

With regard to the relationship of technological attributes with farmers' adoption decision, Rogers (1995) identified five characteristics of agricultural innovations, which are important in adoption studies. These include 1) Relative advantage 2) Compatibility 3) Complexity 4) Trialability and 5) Observability. Rogers (1995) defines these characteristics as follows Relative advantage: Is the degree to which an innovation is perceived as better than the idea it supersedes.

Compatibility: the degree to which the farmer perceives an innovation to be consistent with his/her cultural values and beliefs, traditional management objectives, the existing level of technology and stages of development.

Complexity: the degree to which an innovation is perceived to be complex to understand and use by farmers. Trialability: the degree to which the innovation could easily be tried by farmer on his/her farm Observability: the degree to which results of innovation are visible to farmers.

2.2 Variation and complexity in Agriculture and Seed System

Farming and cropping systems vary along agro-ecologies. They also vary in their objectives for agriculture: livelihood, food supply, and/or income generation. This variation defines the structure of the seed system. The diversity in seed systems is also associated with the type of farmers, subsistence or commercial, or any variation in-between. Another differentiation in seed systems is associated with the crops, whether these are food or feed crops produced for home consumption and/or the market (cereals, pulses, vegetables) or produced as cash crops within a specific value chain (oil crops, vegetables, tobacco, cotton)(ISSD 2012)

Given the different functions of seed in food security, entrepreneurship, technology transfer, and biodiversity, the objective for supporting seed sector development is not solely embedded in policies that target each of those four areas of attention. The multiple objectives create a complexity in which no single strategy for agricultural development, and therefore seed sector development, exists. ISSD as a concept embraces these multiple objectives and this complexity. It uses a system approach to better understand complexity and, consequently, applying a value chain approach identifies different seed systems that operate in parallel, in a dynamic model. These sectors are characterized as the basis for the development of programs and policies aimed at vibrant and pluralistic seed sector development. (Niels and De Boef..2011)

Seed systems are composed of set of dynamic interaction between seed supply and demand, resulting in farm level utilization of seed and thus plant genetic resource. The seed system is essentially the economic and social mechanism by which farmers' demand for seed and various traits they provide met by various possible sources of supply (FAO, 2004).

The term seed system represents the entire complex organization, individual and institution associated with the development, multiplication, processing, storage, distribution and marketing of seed in any country. The seed system includes traditional (or informal) system and the nontraditional (or formal or commercial) systems. Legal institutions such as variety release procedures, intellectual property rights, certification programs, seed standards, contract laws, and law enforcement are also an important component of the seed system of any country. They help determine the quantity, quality, and cost of seeds passing through the seed system (Maredia, *et al.*, 1999).

Activities undertaken to supply seeds to farmers include research and development, multiplication, processing, distribution, and uptake. Other activities that may occur in conjunction with these include transport and storage, as well as quality control (such as seed certification). Seed provision to farmers also includes activities undertaken to influence the process, such as: pricing, financial and technical support, provision of inputs, communication and coordination, as well as market research and promotion. Finally, policy formulation underpins seed systems, defining the boundaries and opportunities for the conduct of all seed system activities (WBG, 1999).

2.2.1 INFORMAL SEED SYSTEM

The first distinction can be made between the formal and informal systems. Informal seed systems cover methods of seed selection, production, and diffusion by farmers, including the exchange of seed. Farmers obtain seed and varieties through informal networks based on exchange with, or gifts from, relatives and neighbors, or through bartering with other farmers or purchasing from local markets. Key issues in determining the use of seed by farmers are availability, quantity and quality, and price. (ISSD 2012)

Seed has to be available, which means that there has to be physical access to the right quantity of seed of the right variety at the right time, and it needs to be affordable. Farm-saved seed is the most prominent source since farmers are familiar with the seed they grow themselves and know that the variety is adapted to local conditions and preferences. Informal seed systems are also referred to as farmer-managed seed systems (Bal & Douglas 1992), traditional seed systems (Cromwell, et al 1992), and local seed systems (Almekinders, et al 1994). We refer to the informal seed system as to distinguish it from the formal system; (Almekinders, et al 1994; Almekinders & Louwaars 1999; Thijssen et al. 2008; Dalton et al. 2010).

The informal seed system has several limitations (Louwaars 2007). The most common one is the assumption that seed is usually readily available in informal systems. In such situations, farmers are not well prepared when facing shortages. Such shortages can be acute, for example, owing to drought or civil unrest, or chronic, basically as a result of poverty and because farmers are unable to put seed aside from the harvest as a result of low productivity (Sperling, et al 2008; Lipper, et al 2010).

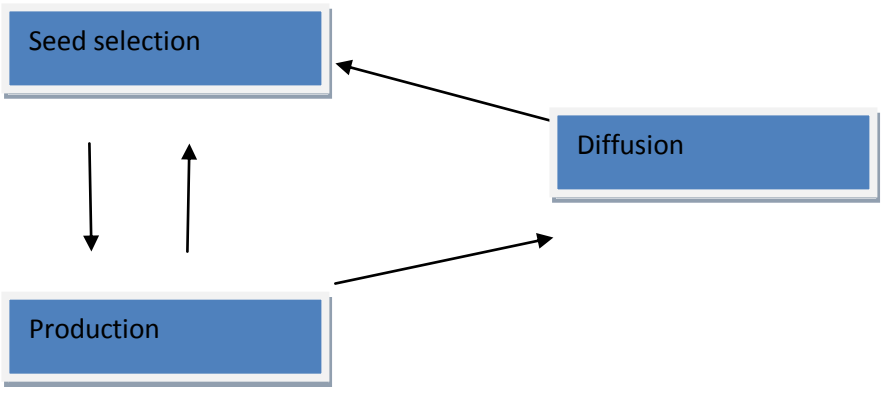


FIGURE 2.2 Informal Seed System.

2.2.3 FORMAL SEED SYSTEM

The formal seed system provides tested seed of uniform varieties that have been evaluated for their adaptation to certain farming systems. The structure of the formal seed system is guided by scientific methodologies for plant breeding and controlled multiplication operated by public or private sector specialists. Significant investments have been made throughout the developing world to improve varieties and to produce and promote quality seed for some major food crops. The formal system is illustrated in a simplified format in Figure 2. (ISSD 2012)

Within the formal seed system, commercial seed production and marketing is only possible for a limited number of crops. The private sector concentrates on hybrids (notably maize) and high-value horticultural crops that can guarantee that all the overheads, including transportation and quality-management costs, will be covered, and that can offer some profit.

Profit margins on self-fertilizing crops like most cereals and legumes are generally low due to competition with farm-saved seed. In some countries (e.g., Brazil, India), commercial companies produce such crops when they can generate enough profits from large quantities or when supplying large commercial farmers only. The private sector generally operates at countrywide and international levels, and involves cash transactions and a profit orientation that results in the production of large quantities of seed and the marketing of just a few varieties with wide adaptation. (Louwaars, 2007).

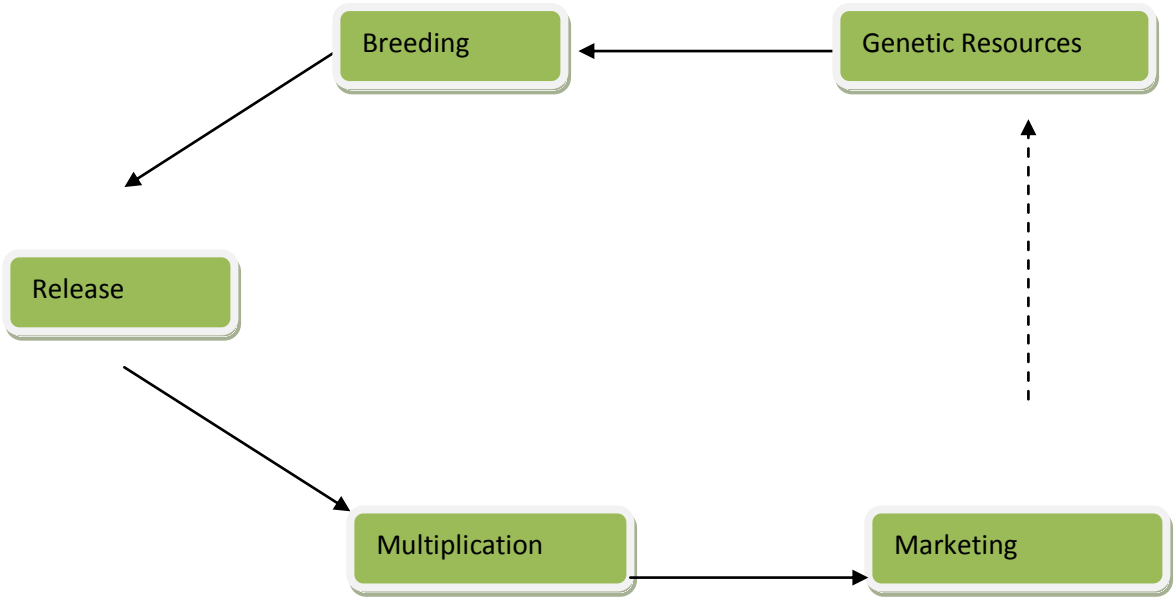


FIGURE 2.3 Formal Seed System

The public sector supports seed systems in different ways, notably by conducting research in breeding, by carrying out varietal development, by organizing (and subsidizing) seed quality control, or by promoting quality seed and improved varieties. Policy and legal frameworks facilitate investment in breeding and seed production, providing access to plant genetic resources, protecting breeders' rights, and ensuring seed quality control. (ISSD 2012)

According to FAO (1999), formal seed system as a sector comprises all seed program components, namely; plant breeding, seed production, processing, marketing, extension, quality control and certification, that interact among themselves and usually regulated by law. The formal seed sector was set up and organized with the principal goal of diffusing quality seed of improved varieties developed by formal breeding programs. The principal sources of materials for formal breeding programs are the *ex situ* collections of gene banks. Gene banks contain materials that were originally collected from farmers' systems, that is—in the case of cultivated plants—materials that were developed and maintained by farmers.

2.3. Seed Development, Production and Distribution in Ethiopia

Seed production follows a generation system to ensure that all seed that is marketed to farmers originates from a known source (breeder seed). When a variety is officially released, the small amount of breeder seed received from the breeder (agricultural research centre) is multiplied through a number of generations before it becomes available to the farmers in larger quantities as certified seed. Each generation is produced under strict supervision and must meet seed quality standards. The number of generations that are allowed after breeder seed depends on the mode of reproduction of the crop, risk of contamination, multiplication ratio and quantity of the seed required. For wheat, four to five generations are commonly used. **(**Zewdie Gregg.2001)

Different generation schemes exist, which vary very little, particularly in nomenclature. The procedures followed are essentially the same.

- Breeder seed is the initial source of seed and is usually produced by the breeder. It is the source for the production of pre-basic or basic seed.
- Pre-basic seed is the progeny of the breeder seed and is usually produced under the supervision of a breeder or his designated agency. This generation is commonly used for crops that have low multiplication ratios and where large quantities of certified seed are required.

- Basic seed is the progeny of breeder or pre-basic seed and is usually produced under the supervision of a breeder or his designated agency and under the control of a seed quality control agency.
- Certified seed is the progeny of basic seed and is produced on contract with selected seed growers under the supervision of the seed enterprise, public or private. Certified seed can be used to produce further generations of certified seed or can be planted by farmers for grain production.**(**A.J.G. van Gastel, Zewdie Bishaw, B.R. Gregg..2001)

The Ethiopian seed industry is composed of formal and informal sectors as well as public and private organization. The formal sectors include federal and regional agricultural research establishments, universities, the regulatory organ in the MoARD, and private companies. The informal sectors encompass millions of farmers, who continue to practice seed selection and preservation, just as their ancestors did (Gezahagn *et al*., 2008).

Policy reforms have so far increased competition and research in the seed industry. There are more firms in the seed industry. Seed sales are less concentrated. Policy changes have also increased the amount of research by foreign owned firms and by local firms. The article also provides evidence that the greater ability of firms to capture benefits from their research through hybrids, the greater the research. This suggests that stronger legal protection of intellectual property would also increase private research. In addition, new technological opportunities based on biotechnology and public plant breeding research contributed to the growth in private research in Ethiopia. (Louwaars, 2007).

To create the right condition for the establishment of strong seed system for production and supply of good quality seed to the farming community, the government formulated the national seed industry policy, which was issued in October 1992. The policies is instrumental to developing a healthy national seed industry conserving and sustain genetic resource, reinforcing crop breeding research and supplying of high quality seed to the farmers to participate in germplasm conservation as well as in the seed production and supply system. It also has an objective of creating a functional and efficient institutional linkage among seed industry participants (Tsgedingil, 2003).

A Ministerial Regulation No. 16/1997, which was enacted to cover registration of varieties, seed producers, processors, distributors, quality control, seed trade (import-export), etc. has been replaced by Seed Proclamation No.206/2000. The latest Proclamation is more comprehensive and creates stronger legal framework for the protection and control of the interests of all players in the seed industry. Moreover, field and seed standards prepared for 74 crops are officially issued for implementation. National seed industry agency (NSIA) has built the necessary capacity to implement and enforce the standards (Gezahagn *et al*., 2008).

Upon release of a new variety, a breeder will make available a small quantity of seed stock that is very pure and represents the variety. This stock is referred to as parental material and forms the basis of any future maintenance and seed multiplication of the variety (Laverack, 1994). Laverack defines maintenance as "the perpetuation of a small stock of parental material through repeated multiplication following a precise procedure". For wheat, an ear-to-row (Plate 74) method is recommended, where a number of ears (depending on the total quantity of certified seed required) that are true-to-type are selected, threshed separately and then planted in individual rows. During the entire growth period, the rows are inspected regularly, and any row with off-types or deviants is discarded. Ears are selected from the remaining rows to repeat the cycle, which is usually referred to as maintenance. The remaining rows are bulk harvested, and the seed is called breeder seed. In India, for example, 1 000 plants are used for wheat variety maintenance (Singh, 1985).

Each year the cycle is repeated to provide a regular supply of breeder seed for further multiplication to basic seed and then to certified seed. Maintenance and breeder seed production is the responsibility of the breeder or the institution that developed the variety. In many developing countries, maintenance is seldom carried out properly, and the responsibility is often taken over by seed production organizations. Some national seed programmes (e.g. Ethiopia) have established special farms to produce early generations (pre-basic and basic seed) to maintain quality and availability. (Singh, 1985).

Despite the crucial importance of improved seed in bettering the livelihoods of small-scale farmers, in Ethiopia access to this invaluable technology is still constrained by many factors.One important factor is the underdeveloped seed industry. Independent studies have estimated a large annual demand for seed, which is never met or (in the case of hybrid maize and sunflower) is met only through imports (Gezahagn *et al*., 2008).

The intention was that this scheme would double the total national production of Certified Seed, while making this seed more available to farmers by virtue of the decentralized approach, as the seed could be sold directly to district MoA offices, or reach neighboring farmers through informal exchange. With this widely-dispersed approach, the FBSPMS sought to be more effective in meeting local demand, and supply seed in a timely and affordable manner. A further goal of the scheme is to organize the most successful seed-producing farmers into producer groups, and support these groups in becoming small independent enterprises specializing in seed production (Gezahagn *et al*., 2008).

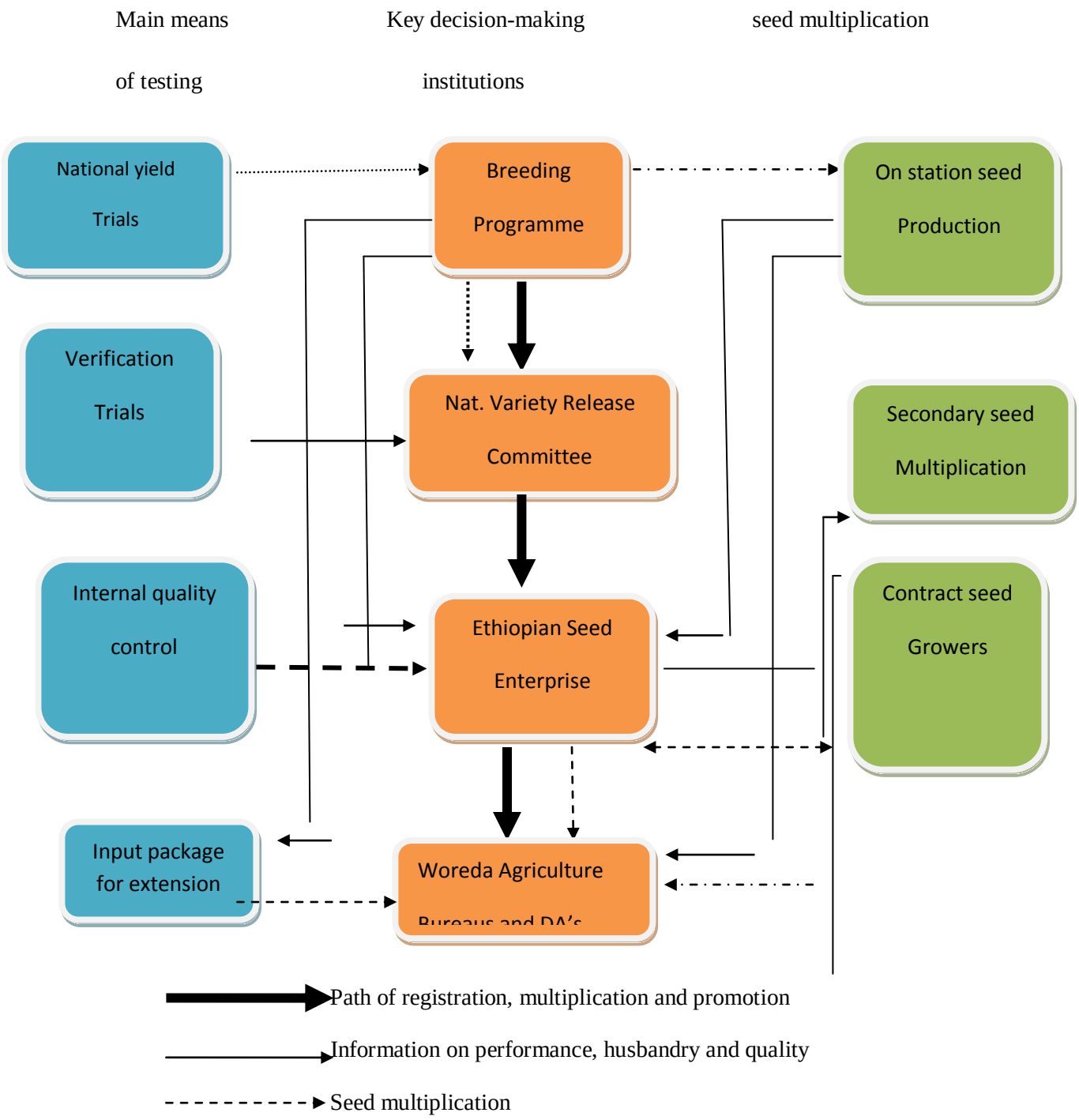


Figure 2.4 Different actor in the seed system of Ethiopia and their relations (Adapted from Shawn McGuire, 2005)

2.4. Seed Market

The definitions of marketing can be grouped in to two major categories: classical (narrow) definitions and modern (broad) definitions. In classical terms, marketing is defined as "the performance of business activities that direct the flow of goods and services from producers to consumers or use or the process in a society by which the demand structure for economic goods and services is anticipated (enlarged) and satisfied through the conception, promotion and physical distribution of such goods and services". These classical definitions of marketing are oriented toward the physical movement of economic goods and services. Marketing is a societal process by which individuals and groups obtain what they need and want through creating, offering, and freely exchanging products and service and value with others. (Louwaars, 2007).

Agricultural marketing is the performance of all business activities involved in the flow of goods and services from point of initial agricultural production until they are in the hands of the ultimate consumer (Kohls and Ihi, 1985 as cited in barker, 1989).

The way in which farmers view their business depends very much on their personal aspirations and opinions. Two extreme positions, which can be identified, are those of 'production-oriented' and the 'marketing –oriented' farmer. The production oriented farmers regards the major part of business as being concerned with the goods, which he wishes to produce. In contrast, the marketing-oriented farmers will endeavor to produce goods which can profitably be sold, giving due consideration to the likelihood of profit before production is undertaken. It has been stated previously that production orientation is likely to be most successful in conditions where a seller's market exist and the control problem to be faced by farmers is to find ways of increasing output. Unfortunately, in agriculture this situation very rarely arises, apart from quirks arising for climate reasons. The marketing orientation concept can be applied to agriculture to a large extent; to date however, there has been only limited amount of work under taken to define the orientation of farmers.(Mitchell(1975),cited in Barker, 1989)

Seed marketing is the most important as well as a challenging aspect of seed industry because of the nature of the product. Seed being a living organism, its quality deteriorate faster. Thus, its shelf life is limited and it must be marketed within the season. Another peculiar feature of seed is that it requires two to three years lead time to meet the specific requirements that is to meet the demand for particular seed, its production has to be organized at least two years in advance.The changes in the weather, price of crop, and price of competing crop, may change the prospects of demand for seed of particular variety at the commencement of sowing season (Singh as cited in Gezahagn 2008).

The nature of seed demanded by farmers differs. Large- and medium-scale farmers use markets to purchase uniform genetic materials that are highly responsive to chemical inputs and embody specific characteristics (e.g., color, uniformity of grain size) rewarded by the market. By contrast, more subsistence-oriented smallholders may value characteristics such as drought tolerance, early maturity or good storage more than fertilizer responsiveness. Because of the small size of their land holdings, mixed cropping practices, and strategy of minimizing production risks by diversifying the variety base, smallholders also demand relatively small quantities of seed but for a number of varieties of the same crop and recycle seed over more seasons than larger commercial farmers (Maredia *et al*., 1999).

Seed demand from different users can be met by promoting a range of seed organizations with comparative cost advantages in supplying seeds of distinct commodities to different groups. For example, multinational seed companies can meet the seed needs of large-scale commercial farmers whose quality requirements and willingness to pay are higher than smallholder farmers.

The seed needs of the latter group can be met more effectively by small-scale firms' or

Community-based Seed Multiplication and Distribution Schemes such as farmers seed groups and Cooperatives (Maredia *et al*., 1999).

The largest problem faced by seed multiplication program elsewhere in Africa is difficulty of building a sustainable seed market. Small quantities of seed are being profitable sold wit in the village community. Sales are strongest for newly introduced varieties. But most small-scale farmers are unwilling to pay premium price to their neighbors for seed they can obtain from their own harvests (Rohrbach *et al*., 2002).

2.4.1 Improved seed marketing in Tigray Region

Seed marketing in the Tigray Region is mainly undertaken by Tigray region BoARD. The Ethiopian seed Enterprise (ESE) is the major seed supplier to the region through its branch office in mekele both the central warehouse and seed producers by farmers in the region. The seed produced by the farmers in the region is on contract basis with a premium price of 15 percent from the prevailing market price of the respective crop. The seed market is subsidized by the regional government as a result; the price of seed is somewhat stable and seed consumption in the region shows continuous increment and distribution of seed increase from year to year with exception of 2009. (see table 1 below)

Table 2.1:- yearly improved seed distribution of Tigray region in quintals

Year	Total/quintals	Percentage change
2002	1,892.25	-
2003	5,190.32	174
2004	11,485.7	121
2005	16,418.634	42
2006	15,670	-4
2007	26,920	71
2008	29,400	8
2009	32.523	17

Source: multipurpose cooperatives annual report 2010

2.5 SEED PRODUCTIVITY

Productivity growth can be defined as the net change in output due to change in efficiency and technical change, where the former is understood to be the change in how far an observation is from the frontier of technology and the latter is understood to be shift in the production frontier (Grosskopf, 1993). For Mahabub (1984), the productivity of an economic system can be defined as the ratio between the output of wealth produced and the inputs of resources used up in the process of production, i.e. it is the functional measure of out put per unit of associated input in the production process.

Productivity can be measured in two ways; partial productivity and total productivity. Partial productivity measures the productivity of each input in the production process, like the productivity of fertilizers, HYVS, pesticides and so on, where as total productivity measures productivity in relation to all inputs.

According to Cheema (1978) productivity growth is an absolute requirement in developing countries and fundamental requisite in many form of planning irrespective of the stage of development and economic and social system. Productivity is the major component of growth and its importance in economic development is universally recognized. The economic achievement of most of the developed countries is attributed to increase in productivity than to anything else. The importance of productivity change in less developed countries can be further argued by the availability of limited resource supply which has high social opportunity cost.

In light with the high growth of population and exhausted possibilities or expanding arable land in developing countries, a shift from a resource based to a more science based system of agriculture will have to play an increasing important role in improving agricultural productivity (Umali, 1995). The growth in agricultural production in Sub Saharan Africa in the past was achieved by expanding the amount of land cultivated, but today there is litter scope for increasing the area under cultivation. Further increase in agricultural production in the area could be achieved only by increasing the productivity of land and labor (Venkatensan and Kampen, 1998). But this requires a generation of effective and efficient agricultural technologies. Moreover, the government of SSA countries should adopt appropriate policies so that farmers apply these technologies to increase productivity (Ibid).

Agricultural productivity of a given farm household depends on many factors in the literature. Ellis (1993) argued that small farms in terms of land size are more productive than large farms and his recommendation that agricultural development strategy based on the promotion of small rather than large farms can serve both growth and income distribution objectives are based on this argument. Empirical studies have also arrived on the same conclusion (Berry and cline, 1979 and Bhalla, 1979).

Other factors like fertilizer, HYVS, pesticides, herbicides, mechanization and the likes have also contributed a lot for productivity growth in different countries. But According to Ellis (1993), the relative success of such technologies depends on an array of natural and socio–economic factors, among which the way market work is of critical importance. A practical example in this regard is the works of Grfftin (1979). He reported that Green Revolution has significantly increased productivity in many Asian and Latin America countries over the last four decades. But that is not the case in Africa because African farmers shown litter interest in these technologies. Adoption of HYVS is not typical to Africa because these varieties generally perform well only under a controlled environment where there is no shortage of water (using irrigation) and where chemical inputs can be widely used. In general, there is little irrigation available and inputs are scarce in Africa. So the problem is not so much of developing HYVS that need a lot of care, but of growing varieties that can adapt to a difficult environment and eventually develop resistance to several diseases.

The paper doesn't deal with all modern agricultural inputs, rather is restricted to HYVS, fertilizers and chemicals. HYVS are those seeds which have not only higher yield, but also resist disease and pest, tolerate draught and have shorter growing period. Such seeds have resulted in a substantial increase in output in many countries, but to realize their potential, they highly depend on complimentary purchased inputs. The potential of HYVS is not affected by farm size, scale or Socio– economic status because they are infinitely divisible (Ellis, 1993). But location endowments like natural soil, water,

irrigation, infrastructural disparities affect their potential. For example, Chambers et al. (1989) stated that HYVS are less successful in resource poor and semi arid environment like in Africa.

2.6 Role of Cooperatives in facilitating Seed business

Cooperatives play a vital role in seed distribution by arranging financial access for seed credit through Farmers' Cooperative Unions (FCU) and supplying the seed to farmers at their village. The Cooperatives facilitate seed supply and distribution by transporting, storing and supplying to their members and the community at village level; which has direct impact to improve productivity of the farmers. The share of FCUs in seed supply to small farmers is now growing very rapidly.LSB 2009

Some Cooperatives start to takeover responsibility of managing the community based seed bank (CBSB) transferred from Relief Society of Tigray (REST), which could be a good opportunity for the local seed business in the future. In Tigray there are more than 593 Multipurpose Cooperative Societies, 371 Saving and credit Cooperative, 174 irrigation Cooperatives, 207 livestock and livestock products marketing Cooperatives, 41 consumer and 316 construction related and 123 artisan cooperatives with more than 406,377 members of which 103,355 are female member beneficiaries, (TCPA, 2008).

2.7 The Local Seed Business Constraints in Ethiopia

The existing private and public companies in Ethiopia produce limited amount of seed that do not cope with the growing demand in the country due to both technical and organizational low capacity. According to Ethiopian Seed Trade Association (ESTA) annual report, over 95% of seed sources come from farm-saved seed of non-improved land races. The total seed requirement (potential demand) is estimated at 400,000 to 500,000 Metric tons of the major cereal crops, where as the seed supply is as low as less than 6% of the potential demand for all crops per year. In addition, seed production and distribution is faced with substandard seed quality, low access to credit facilities, less focus and poor extension service on quality local seed production and limited market oriented extension work, absence of local seed marketing facilities, services and equipments, absence of an organized seed system, loose coordination among stakeholders. LSB 2007

2.8 Conceptual Framework of the Study

Agricultural technology adoption and diffusion patterns often vary from location to location. The variations in adoption patterns were created due to the presence of disparity in agroecology, institutional and social factors. Moreover farmers' adoption behaviour, especially in low-income countries, is influenced by a complex set of socio- economic, demographic, technical, institutional and biophysical factors (Feder et al, 1985).

Adoption rates were also noted to vary between different group of farmers due to differences in access to resources (land, labor, and capital) credit, & information and differences in farmers' perceptions of risks and profits associated with new technology. The direction and degree of impact of adoption determinants are not uniform; the impact varies depending on type of technology and the conditions of areas where the technology is to be introduced (Legesse, 1998).

Farmers' decision to adopt or reject new technologies can also be influenced by factors related to their objectives and constraints. These factors include farmers' resource endowments as measured by (1) size of family labors, farm size and oxen ownership, (2) farmers' socio–economic circumstance (age, and formal education) and (3) institutional support system available for inputs (CIMMIYT, 1993).

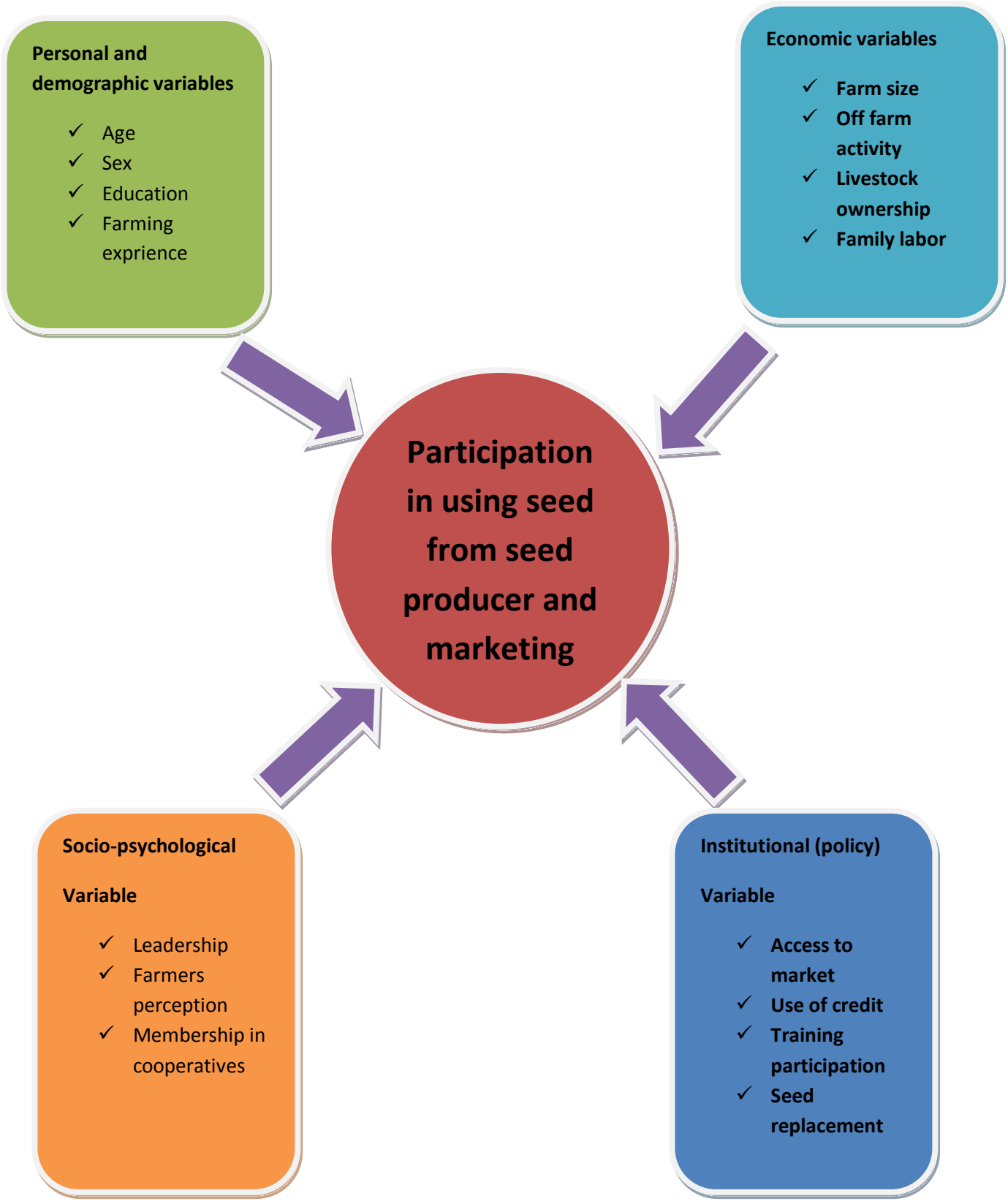
In many developing countries, it has become apparent that generating new technology alone has not provided solution to help poor farmers to increase agricultural productivity and achieve higher standards of living. In spite of the efforts of National and International development organizations, the problem of technology adoption and hence low agricultural productivity is still a major concern (CIMMIYT, 1993).

In this study efforts will be made to figure out factors affecting intensity of adoption, the pattern and direction of adoption of improved wheat seed production that varied according to farmers' personal characteristics, accessibilities to different services such as credit, extension, information market and Psychological factors.

Moreover literature, practical experiences and field observations have confirmed that technology adoption by farmers' can be enhanced in a sustainable manner by understanding those factors influencing the pattern, degree and direction of adoption and by designing and establishing technologies diffusion and adoption pattern strategies through farmers empowering, increasing farmers access to infrastructure, information, credit, field support, etc and acquainting them about how to utilize the technology.

Farmers' participation in technology development, and dissemination strategies as well as result evaluation should be considered, because farmers have long years of farming experience and acquaintance with environmental conditions. The need and interest of farmers' towards agricultural innovations also varies depending on farmers' farming environment, their belief, experience, economic status and their personal background. Therefore, disseminating improved agricultural technologies without consultation of farmers most probably ends with failure.

Practical experiences and observations of the reality have shown that one factor may enhance adoption of one technology in one specific area for certain period of time and may create hindrance for other locations. Because of this reason, it is difficult to develop a one and unified adoption model in technology adoption process for all specific locations. Therefore the type of technology that fits for all should not be accepted by technology users due to their different situations. Hence, the conceptual framework presented in the Figure shows the most important variables expected to influence the intensity of adoption of improved wheat seed production in the study area.


Personal and demographic variables
Age
Sex
Education
Farming exprience
Economic variables
Farm size
Off farm activity
Livestock ownership
Family labor
Participation in using seed from seed producer and marketing
Socio-psychological Variable
Leadership
Farmers perception
Membership in cooperatives
Institutional (policy) Variable
Access to market
Use of credit
Training participation
Seed replacement

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1 Description of the Study Area

Endamokni woreda is located 660 km north of Addis Ababa and about 120 km south of Tigray Regional state capital of Mekelle. The *woreda* is geographically located 390 32' N latitude and 120 47' E longitudes. It is located south of Tigray region, north of Ofla *woreda*, west of Raya azebo *woreda*, east of Amhara region and south of Alaje wereda. There are 18 rural *kebeles* and 2 sub cities. Maichew is the capital city of the woreda. (BoPF, 2011).

According to the recent *woreda* population reports (2004EC), the total number of rural households in 18 rural k*ebeles* in the *woreda* is 22,093. Out of these, 11,099(50.23 %) are men headed and 10,994 (49.77 %) are women headed households. The total *woreda* population is 94,367, out of which 46,830 (49.62 %) are male and 47,537 (50.38 %) are female. Economically active population of the *woreda* (15-55 years of age) is 52,176 people out of which, 25,668 are male and 26,508 are female.(BoPf..annual statistical bulletine2003)

The altitude in the woreda ranges from 1800 to 3250 m.a.s.l, but most of the woreda is found at about 2200 m.a.s.l and the highest mountain of Tigray "*Tsibet*" which is 3935 m.a.s.l is found in the *woreda*. The woreda mean annual temperature varies from 12^0c to 18.5^oc. The climate of the *woreda* is classified into three agro-climatological zones:High land representing 65%, midland (weynadega) 30% and low land 5%. The average annual rain fall of the woreda ranges from 600 to 800mm(DCSZA, 2008). The woreda is characterized by mixed farming system where crop and livestock production are the main activities, where crops play the dominants role in terms of contribution to farmers income.

Table 3.1. Land use type with its area coverage

S.N	Land use	Area coverage(ha)
1	Potentially cultivable	**17,992.00**
2	Grazing land	**14,463.75**
3	Forest	**16,910.70**
4	Uncultivable land (hills)	**1,094.15**
5	Others(settlement)	**11,039.40**
	Total	**61,500.00**

Source: Endamokoni woreda rural development (2010) cited in annual report.

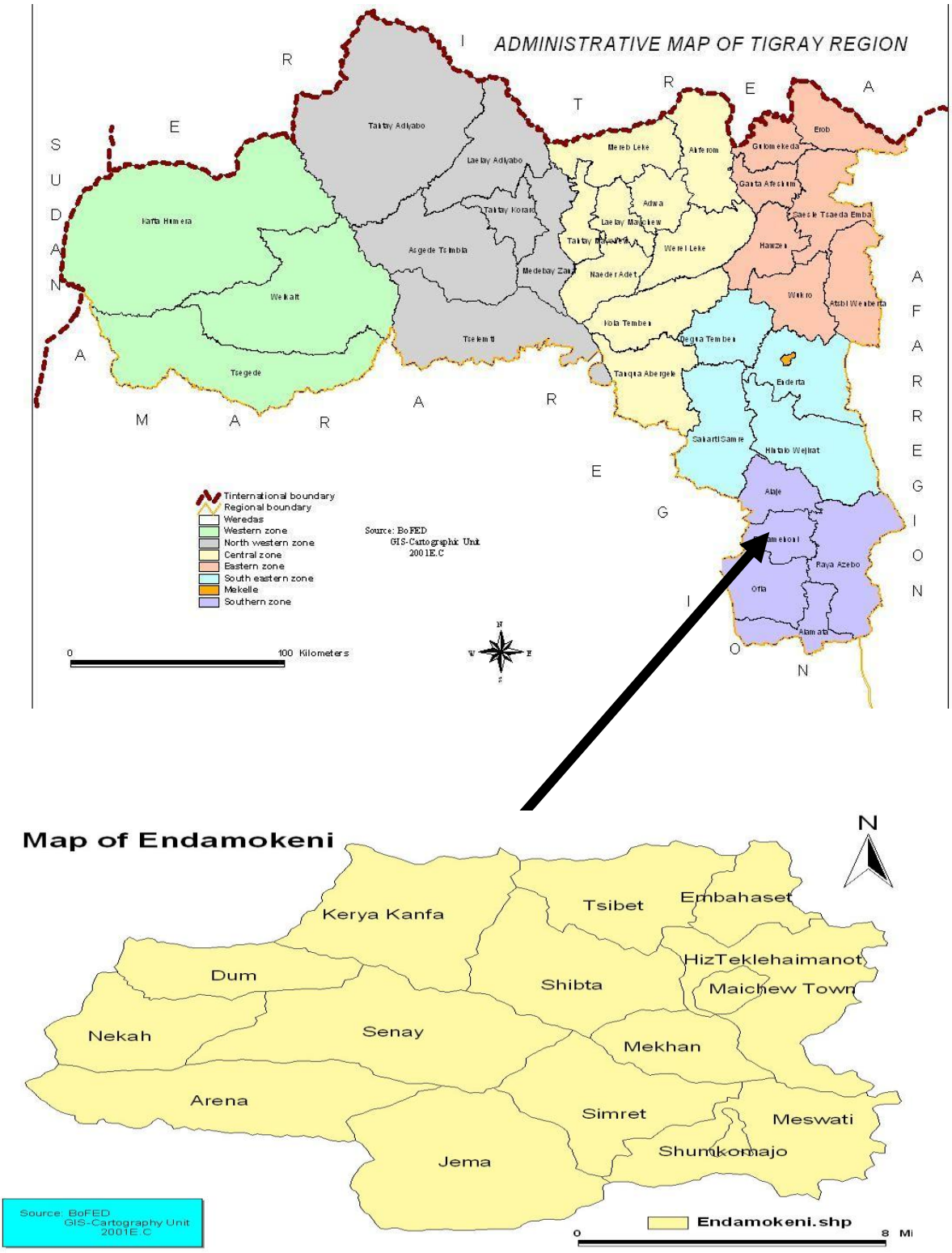


Figure 3.1 Map of Tigray Regional State and Endamokoni Woreda

3.2 Sampling Procedure

The sample households were selected by utilizing a four-stage stratified sampling procedure During the first stage, from the five *woredas* (established seed producer and marketing cooperatives) supported by Integrated Seed Sector Development (ISSD)) one *woreda* was purposely selected, namely Endamokoni woreda. The fact that this woreda have both the seed users (purchaser) from those cooperatives supported by ISSD and those who do not (does it mean there are restrictions to the extent that they don\t buy) have the access to purchase or use from cooperatives and experienced to purchase from government agency and who use also from their last year crop production as seed input.

Similarly at the second stage, in consultation with Woreda office of Agriculture and Rural Development (WoARD), three kebelles were purposely chosen. The study kebelles were chosen based on seed customers from the seed producer and marketing cooperatives and seed users from other alternatives.

At the third stage, lists of households were obtained from kebelle administration. Extension agents of the respective kebelles classified the households list again by type of seed they used for production. Seed customers from the SPC's were defined as those who are seed customer if they use the seed for more than one year. Non–SPC seed customer was defined as farmers who lived in the same woreda but have not participated in any seed use from the SPC's within the same period. Having these two gropus the later groups were treated as a control group in the study in relation to impact assessments against seed customer households from the seed producer and marketing cooperatives. The key difference between the two sample household groups was that beneficiary groups had access to purchase and use seed from the SPC's while the control group or non-beneficiary groups did not have access to purchase and use seed from the SPC's. This was done to obtain clear evidence on the impact of those seed producer and marketing cooperatives on wheat crop production and its implication to food security.

The final stage was included a household listing followed by a systemic random sampling technique to select sample households from each household category. The households was selected in such a way that households that have accessibility to buy and use seed from those SPC's in the treated category and farmers who does not have the access to use and buy seed from the SPC'sin the control category was included in the sample. Based on this multi stage sampling process a total of 160 households from all the users and non users of seed from SPC were selected on a random sampling basis from 3 kebeles of Endamokoni wereda.

3.3 Data Type, source and collection Methods

A single household will be taken as the basic survey unit for the analysis. A household was defined as a number of people (it might be only one person) living and eating together in the same dwelling who share the same budget (Upton, 1996 as cited in Tesfay 2008). Given that the household was a production unit, a farm was defined as all the agricultural activities under the control of the household members. Primary and secondary data was collected to answer the research questions and achieve the objectives of this study.

The interest of the respondents in survey work was an issue given top priority. Farmers may show little cooperation unless their concerns were taken care of very seriously. Therefore, in order to gain their trust, the respondents were carefully informed about the objectives of the survey and the direct and indirect benefits to them. In this regard, chair-persons of the respective rural kebeles were first approached and efforts were made to convince them of the objectives of the study. Farmers were also informed that information related to household and farm characteristics would be kept confidential.

Firstly, the interview schedule was tested at the farm level on 10 randomly selected farm households. In the light of pre-testing, essential amendments was made on such things as ordering and wording of questions and coverage of the interview schedule. Furthermore, the pre-test enable to know whether farmers have clearly understood the interview schedule.

After pre-testing and prior to the final administration of the interview schedule, enumerators were given training and briefings on the objective, contents of the interview schedule and was also acquaint with the basic techniques of data gathering and interviewing techniques and on how to approach farmers. Then using the amended structured interview schedule, primary data was collected by using personal interview technique from sampled farmers. The interview schedule was administered by using trained enumerators. In order to increase the reliability of the survey data and to reduce technical and linguistic problems at the farm level appropriate supervision was made by the researcher

3.4 Data Analysis Methodology

In the assessment and analysis of data for the Role of seed producers and marketing cooperatives on wheat crop production and its implication to food security both quantitative and qualitative approach was used. For the quantitative approach the Heckman two-stage, FGT was applied and for the qualitative focus group discussion, key informant interviews and observation was implemented.

3.4.1 Role (Impact) Measurement

The conventional approach to assessing the impact of an intervention using with and without approach method has essentially been hampered by a problem of missing data. Due to this problem, the impact of an intervention cannot be accurately estimated by simply comparing the outcome of the treatment group with the outcome control groups (Heckman et al., 1998). One of the alternative techniques followed in the recent literature to assess the impact of a discrete treatment on an outcome is the method of Heckman two-stage.

In measuring impact evaluation there are a lot of mechanisms like PSM (prosperity Score Matching), IV (Instrumental Variables), DID (Difference in Difference) and Heckman. Those mechanisms have their own advantage and limitations. The above methods vary by their underlying assumptions regarding how to resolve selection bias in estimating the program treatment effect and their use of sample selection which has remarkable impact on the quality of the result obtained

Prosperity Score Matching (PSM) methods compare treatment effects across participant and matched nonparticipant units, with the matching conducted on a range of observed characteristics (World Bank 2010). PSM measures the impact outcome using a high number of sample sizes.

Difference in Difference (DID) methods assume that unobserved selection is present and that it is time invariant—the treatment effect is determined by taking the difference in outcomes across treatment and control units before and after the program intervention(world bank 2010). DID methods can be used in both experimental and non experimental settings but requires baseline survey to see the difference in outcome.

Instrumental Variables (IV) models can be used with cross-section or panel data. In the IV approach, selection bias on unobserved characteristics is corrected by finding a variable (or instrument) that is correlated with participation but not correlated with unobserved characteristics affecting the outcome; this instrument is used to predict participation. Instrumental variable needs a unique variable that can use as an instrument.

However, in this research applying IV or PSM was difficult as there was neither baseline survey nor unique variable of participants to hiryti-mekan seed producer and marketing cooperative. Likewise the researcher could not afford to conduct the study on mass base (having more smaple size) sample size more than 160 because of small size of customers to see the impact of spc on the treated(participants). All theses enforced the researcher to apply a method that can easily enable to answer the aforementioned research questions, the Heckman two stage model

3.4.1.1 Impact of seed producer and marketing cooperative on crop production of farmers

In many of the less developed agrarian economies agricultural productivity is extremely low even though increasing agricultural productivity is critical to economic growth and development. One important way to increase agricultural productivity is through the introduction of improved agricultural technology and management systems, and applying better seed quality is one.

Related to this policy makers and researchers tried to investigate the matter, though simple descriptive statistics about the use and diffusion of new seed varieties and associated technologies such as fertilizer and irrigation (Doss 2003). Following this much concern arose later about the impact of technology practice mainly focusing on agricultural commodity production, on poverty and malnutrition, on farm size and input use in agriculture, on genetic diversity and on variety of social status. Generally speaking most of the studies related to impact of technological practice did produce enough results and conclusions. This may explain that after the technological practice intervention, the proportion of population of technology user households that faced low productivity dramatically increased their productivity in comparison to the pre technological practice status. This indicates that the availability of technological practice has enabled beneficiary farmers to undertake multiple cropping and crop diversification, and see overall higher production (i.e to be used both for household consumption and sale). This, in turn led to some high productivity situations among the technology users.(ibid)

For further decision whether to introduce and diffuse new technology practice or not, impact assessment is important. In this study, wheat crop production will be undertaken by household where the necessary supply of labour and capital come from in this woreda.

Basically the ISSD project aim is to transform the seed producer cooperatives thorough helping to produce marketable output thereby increases their income and give supply with a quality and timely seed to the farmers in the woreda as well as to the Ethiopian seed Enterprise.

3.4.1.2 Econometric analysis

Heckman two-stage procedure: Evaluating the impact of an institution or a program on an outcome variable using regression analysis can lead to biased estimate if the underlying process which governs "selection in to the institution or a program is not incorporated in the empirical framework. The reason for this is that, the effect of the program or an institution may be over (under) estimated if program or an institution participants are more (less) able due to certain unobservable characteristics, to derive these benefits compared to eligible non-participants (Zaman, 2001 as cited in Abonesh 2010).

To evaluate the benefit from an institution, a model commonly employed is the following

$$y = X\beta + \alpha I + u \quad \text{.....(3.1)}$$

Where Y is the outcome, X is a vector of personal exogenous characteristics and I is a dummy variable (I=1 if the individual participates in the institution (SPC) and 0 otherwise). For this model, the effect of the institution (SPC) is measured by the estimate of α. However, the dummy variable 'I' cannot be treated as exogenous if the decision of an individual to participate or not to participate in the institution (SPC) is based on an individual self selection (Maddala, 1983).

One solution to this problem in econometrics is the application of Heckman two-stage procedures. The Heckman model is a response to sample selection bias. It is the appropriate tool to test and control sample selection biases (Wooldrige, 2002 as cited in Abonesh 2010).

The first stage models a 'participation equation', attempts to capture the factors governing membership in a institution (SPC). This equation is used to due to the nature of the data, a fit model to construct a selectivity term known as the 'Mills ratio' which is added to the second stage 'outcome' equation. If the coefficient of the 'selectivity' term is significant then the hypothesis that the participation equation is governed by an unobserved selection process is confirmed. It also enables to verify that the method is relevant to the nature of the data. Moreover, with the inclusion of extra term, the coefficient in the second stage 'selectivity corrected' equation is unbiased (Zaman, 2001).

Some studies show that classical linear regression methodology is applied to the analysis of samples with self selectivity component which are not without limitations. A study by Dardis et al. (1994) discusses that in the application of classical linear regression model on tourism expenditure the large number of nil observation assigned to individuals who do not take a holiday in the period analyzed leads to a situation in which the application of the classical linear regression model does not guarantee consistent and unbiased estimates of the parameter. The correct method would be to model the decisions which cause zeros along with the expenditure decisions (Maddala, 1992). This implies the decomposition of the tourist choice process in to two stages: decision to take a holiday and expenditure incurred on a holiday through the estimation of Heckman tow-step procedure (Heckman, 1979). A study by Sigelman and Zeng (1999) specified a model with self selection (selectivity bias) as follows:

$$Z_i^* = W_i\gamma + \mu_i \quad \text{.....(3.2)}$$

$$Y_i = X_i\beta + \varepsilon_i \quad \text{observed only if } Z_i^* > 0 \quad \text{.....(3.3)}$$

Where the error terms (μ_i and ε_i) are assumed to follow a bivariate normal distribution with mean 0, variances $\sigma_\mu and \sigma_\varepsilon$, and correlation coefficient ρ . The application of ordinary least square estimation using the observed y is biased and the estimates will be inconsistent. Hence,Heckman's (1979) two-step procedure is usually employed instead.

A study by Dardis et al. (1994) applied the censored regression (Tobit) model in the analysis of tourism expenditure, as it allows for inclusion of all expenditure observations zero and positive, thus minimizing the problem of bias and inconsistency. However, the Tobit model also presents problems. Firstly, this model is based on the assumption of censored data; which means that it is assumed that only realization above a certain value are observed, which would be seen as a data defect (Greene, 2003). Moreover, the application of the Tobit model for a data with no censorial problem gives a poor fit and produce significant bias in the estimation.

Therefore, to study the role of seed producer cooperative on the wheat crop production, we should incorporate the underlying process which governs self selection in to the using seed from SPC. This is because role of seed producer cooperative on the wheat crop production is a compound of its impact on participation and the outcome equations.

In view of the need to estimate the selection process in to the participation of using seed from SPC we use the Heckman two- step procedure which first estimates the participation equation (the probability of participating in using seed from SPC) and derives maximum likelihood estimates from the coefficient of the participation equation. Using these estimates a variable known as the Mills ratio is constructed. The Mills ratio is the tool for controlling bias due to sample selection (Heckman, 1979). The second stage involves including the Mills ratio to the wheat crop production equation and estimating the equation using ordinary least square technique.

Specification of the Heckman two-step procedure: let Z_{ik} be a group of variables K which represent the characteristics of household i which determine the decision to participate in using seed from SPC measured by a latent variable D_i^* and γ_k are the coefficients which reflect the effect of these variables on participation; and X_{is} is a group of variables S which represent the characteristics of household i which determine household wheat crop production C_i and β_s are the coefficients which reflect the effect of these variables on Household wheat crop production.

Thus, the Heckman two-step procedure takes the following form:

$$D_i^* = \sum_{k=1}^{k} \gamma_k Z_{ik} + u_i \quad \text{.....(3.4)}$$

$$C_i = \sum_{s=1}^{s} \beta_s X_{is} + \varepsilon_i \text{ Observed only if } D_i^* > 0 \quad \text{.....(3.5)}$$

Where the disturbances u_i and ε_i follow a bivariate normal distribution with a zero mean, variance σ_u and σ_ε respectively, and covariance $\sigma_{\varepsilon u}$. Therefore, we define a dichotomous variable D_i which takes a value 1 when the latent variable $D_i^* > 0$ and 0 otherwise. In this way

$D_i = 1$ indicates the participation in using seed from SPC and $D_i = 0$ that of not participating in using seed from SPC.

The estimator is based on the conditional expectation of the observed variable, household wheat crop production

$$E(C_i / d_i^* > 0) = x\beta + \sigma_{\varepsilon u}\sigma_\varepsilon(-\gamma z) \quad \text{.....(3.6)}$$

Where λ is the inverse Mills ratio defined as $\lambda(-\gamma Z) = \phi(-\gamma Z) \div (1 - \varphi(-\gamma Z))$; β and γ are the vectors of parameters which measure the effect of variables x and z; ϕ and φ are the functions of density and distribution of a normal, respectively. The expression of conditional expectation shows that C_i equals $x\beta$ only when the errors u_i and ε_i are non correlated, $\sigma_{\varepsilon u} = 0$; otherwise, the expectation of C_i is affected by the variable of equation (3.4)

Thus, from expression (3.6), we find that

$$C_i / d_i^* > 0 = E(C_i / d_i^* > 0) + V_i = x\beta + \sigma_{\varepsilon u}\sigma_\varepsilon \lambda(-\gamma z) + V_i \quad \text{.....(3.7)}$$

Where vi is the distributed error term $N(0, \sigma_\varepsilon(1 - \sigma_{\varepsilon u}(\lambda(\lambda - \gamma z))))$

Therefore, in our two stage choice context we simultaneously model participate in using seed from spc and the Role of seed producer and marketing cooperative on wheat crop production and its implication to food security.

Test of multicollinearity and heteroskedasticity

Before fitting the model it is necessary to carry out multicollinearity test because of the fact that multicollinearity may cause lack of significance of individual independent variables, while the overall model may be strongly significant (Monteshwe, 2006). It may also result in wrong signs and magnitudes of regression coefficient estimates and consequently in incorrect conclusions about relationships between independent variables.

Different methods are often suggested to detect multicoliniarity problem among them, Variance Inflation Factor (VIF) technique was employed to detect mulicoliniarity in continuous explanatory variable. According to Gujarati (1995), VIF (Xi) can be defined as:

$$VIF = {}^{1}/_{1 - R^2}$$

Where R_i^2 is the multiple correlation coefficients between X_i and other explanatory variables, for each selected continuous variable (X_i) were regressed on all other continuous explanatory variable .The coefficient of determination (R_i^2) constructed for each case. The larger the value of R_i^2 ,the higher the value of VIF (X_i) causing higher multicolinearity in the variable (Xi) for continuous variables. If the value of VIF is 10 and above the variables are said to be collinear (if the value of R_2 is 1), it would result in higher VIF and cause perfect collinearity between variables.

Contingency coefficients were also calculated to detect the degree of association among the dummy variables. Contingency coefficient is the Chi-square based measure of association. A value of 0.75 or more indicates a stronger relationship (Healy, 1984; cited in Paulos, 2002). The contingency coefficient was computed as follow:

$$C = \sqrt{{}^{X^2}/_{N + X^2}}$$

Where C= Contingency Coefficient, χ 2 = Chi-square test, N= total sample number

If normality or homoskedasticity fail to hold, the Probit model may be meaningless. In OLS, estimates are consistent but not efficient when the disturbances are heteroscedatic. In the case of the limited dependent variable models also, if we ignore heteroscedasticity, the result estimates are not even consistent i.e. is the regression coefficient is upward biased (Maddala, 1997). In this study heteroscedasticity was tested for some suspected variables by running, heteroscedatic probit using econometric software (STATA). For the convenience of computing the marginal effects and participation probabilities, in the study, the probit model was estimated by simply excluding the variables which were found to be significant for heteroscedasticity.

3.4.2 Variables of the Model

The dependent variable for the first stage of the Heckman two-stage procedure is participation in using seed from SPC. This variable is a dummy variable (given a value of 1 if the household participates in using seed from SPC and 0 otherwise) for the second stage of the model household wheat crop production is a continuous variable measured in Birr.

Independent (explanatory) variables: The explanatory variables of importance in this study are those variables, which are thought to have influence on Role of seed producer and marketing cooperative on wheat crop production and its implication to food security. These include household's personal and demographic variables, economic variables, household socio-psychological variables and institutional variables. These explanatory variables are defined as follows

1. Participation in using seed from SPC: it is hypothesized that access to participate in using seed from SPC increases wheat crop production. The variable is entered the model as a dummy variable (takes a value of 1 if the household has access to participate in using seed from SPC and 0 otherwise).

2**. Age of the household head** – a study conducted by Abebaw (2003) indicated that age has significant effect on household crop production. That is, the older the household head, the more experience he has in farming and weather forecasting. As a result, the chance for such household to be crop producer is high. Therefore, it is hypothesized that age of household head has positive impact on household wheat crop production. This variable is a continuous variable measured in number of years.

3. Household size: this variable refers to the size of household members converted in to adult equivalent. The existence of a large household size positively influences household wheat crop production (Mulugeta, 2002). Therefore, it is expected that household size and wheat crop production are positive related. It is a continuous variable measured in the number of adult equivalent.

4. Sex of household head: it is hypothesized that male-headed households are in a better position to pull labor force than the female headed ones. Christina et al., (2001) states that women farmers may need a long adjustment period to diversify their income sources fully and to participate in institutions like SPC. Belayneh (2005) identified that male headed households are higher crop production than female headed households. This variable is entered the model as dummy variable (takes a value of 1 if the household head is male and 0 otherwise) and expected to have a positive relation ship with household high wheat crop production.

5. Size of cultivated land: Mulugeta (2002) and Ayalew (2003) identified that size of cultivated land has positive impact on household wheat crop production. This variable represents the total cultivated land size (both irrigated and rain fed) of a household measured in hectare. It is hypothesized that farmers who have larger cultivated land are more likely to be high wheat crop production than those with smaller area and to participate in using seed from SPC. A positive relationship is expected between household high wheat crop production and cultivated land size.

6. Total livestock ownership (TLU): This refers to the total number of animals possessed by the household measured in tropical livestock unit (TLU). Livestock is considered as another capital which is liquid and a security against crop failure. Moreover, livestock used for threshing, transporting and etc hence increase production thereby farmers' income. Therefore, this variable will be hypothesized to have a positive impact on farmers' wheat production.

7. **Mass media exposure:** Mass media plays an important role in the adoption of agricultural technology. Access here is defined as an ownership of any of the two mass media. A person who has an access to Radio or TV will be given a value of 1 and similarly the one who has no access to either of the two will be given a value of 0. Access to Radio & TV is expected to have positive influence on wheat crop production as well as participation of using seed from SPC by the farmers and will have positive effect on wheat crop production, (Kidane 2001).

8. Irrigation: it is hypothesized that access to irrigation increases wheat crop production as well participation in using seed from SPC. Abebaw (2003) indicated that irrigation reduces the risk of food insecurity and increase crop production. Therefore, it is assumed that access to irrigation and household wheat crop production has a positive relationship. The variable is entered the model as a dummy variable (takes a value of 1 if the household has access to irrigation and 0 otherwise).

9. Access to market: Access to market is hypothesized to be positively related to the probability of wheat crop production. If the households located near to market tend to buy improved agricultural inputs and they can have easy access to sell their product in the market.

Therefore, the variable will be treated as a dummy variable in that if the household has an access to market has coded as 1and 0, otherwise. As market distance increases wheat crop production will be expected to decrease,(Dereje 2006) and (Rahimeto 2007).-

10. Social statues: membership and leadership in community organization assumes that farmers who have some position in rural kebeles and different cooperatives are more likely to be aware of new practices as they are easily exposed to information (Freeman *et al*, 1996; Chilot *et al*, 1996; van Den Ban and Hawkins, 1996; Asfew *et al*, 1997; Habtemariam, 2004). It is, therefore, hypothesized that

those farmers who participated in some social organization as member or leader are more likely to participate in using seed from SPC.

11. Access to credit service: it is hypothesized that accesses to credit and wheat crop production have positive relationship. The variable is entered the model as a dummy variable (it takes a value 1 if the household has access to credit service and 0 otherwise).

12. Extension services: a dummy variable for extension contact: =1 if the household is contacted by an extension worker in the last two years; 0 otherwise. Farmers having extension contact knows the source and possible benefit of wheat crop production and using seed from SPC and hence expected to be better adopters. Hence, it will be hypothesized to affect wheat crop production positively.-

13. Participation in training: Training is one of the means by which farmers acquire new knowledge and skills and it is measured by the number of times, the farmer has participated in training in the last three years. Hence, participation in training is expected to positively influence farmers' adoption behavior of wheat crop production (Dereje 2006).

14. Farmers' perception of about Hiyti-Mekan SPC: if the perception to the Hiyti-Mekan SPC is good the household can participate in using seed from SPC and if the perception is not good the household's participation affects and wheat crop production will be decrease. Thus, it is expected that households with good perception in using seed from SPC are more high wheat crop producers than households have not good perception in using seed from SPC. This variable is entered the model as a dummy variable (it takes a value 1 if the household with good perception in using seed from SPC and 0 otherwise).

15. Nearness of the household to the SPC: nearness of the households to the SPC is expected to determine both the household's participation in using seed from SPC and improving household wheat crop production. This variable is a continuous variable measured in kilometer.

3.4.2 Measuring Household Food Security

Using the available data, food security measurement can be estimated through several feasible methods. In this study the food energy intake method by Greer and Thorbecke (1986) was employed for ease of computation. What the food energy intake method is aiming to do is find a monetary value of the poverty line at which "basic needs" are met. Food energy intake will naturally vary at a given expenditure level. Recognizing this fact the method typically calculates an expected value of intake.

There are a number of conceptual methods for estimating the poverty line (Food poverty line). The two most common approaches are: the Direct Calorie Intake (DCI) Approach and the Food Energy Intake (FEI) Approach. These methods differ in terms of their approach, to estimate the threshold or poverty line.

The direct calorie intake method to measure poverty, considers as poor any household not meeting the minimum nutritional requirement that satisfies basic human consumption needs for good health. This study uses a requirement of 2200 kilocalories per day per person as a benchmark of nutritional requirement consumed by each household. Based on the direct caloric intake method, poor is defined as any person whose intake was below 2220 calories per person on a daily basis (Hagos and Holden,2003 as cited in Haile 20008) The difficulty with this method is that it equates poverty with malnutrition or a proxy thereof. The weakness of the direct caloric intake method is that it considers poverty as a lack of access to basic goods and services. Measuring poverty solely by caloric intake is unlikely to adequately represent the multifaceted state of deprivation that those in poverty experience and provides a lack of consistency of its threshold or poverty line (Ravalion, 1998).

The second approach is food energy intake approach: the premise of this method is to find the actual value of per capita consumption at which a household can be expected to fulfill its caloric requirement; this means that the poverty line is defined by the level of per capita consumption at which people can be expected to meet this nutritional requirement. This represents a methodological improvement in terms of representativeness because the food energy intake method provides a monetary rather than purely nutritional concept of poverty. However, the method suffers from major deficiencies in terms of consistency, the poverty lines generated might not represent an identical level of welfare (specifically, an identical purchasing power parity in real terms) over time or across groups and, hence, poverty comparisons may not be valid or comparable. An example of this is that: the poverty line is estimated by dividing household expenditures by the number of people in the household. This is the simplest way of calculating the poverty line.(Desta 2011)

Therefore, the consumption data collected from the household survey were used to generate food poverty lines: extreme poverty line and moderate poverty lines. The food poverty line describes the amount of money a person requires to purchase a typical basket of local food items that generate the minimum daily needed calories to preserve human life, which is estimated at 2200 calories per adult per day. This rate is commonly used in many studies in Ethiopia (Hagos and Holden,2003).

The steps followed in this study to derive the food poverty line (poverty line) were: A typical food bundle used to estimate the food poverty line was constructed by taking the food consumption characteristics of the poorest 50% surveyed in the sample population. Considering this, 18 different types of food items which are commonly consumed in all study areas were taken for the estimation of the food poverty lines. This was calculated based on the cost of an adult equivalent attaining the minimum nutritional requirement of 2200 calories per day.

Using the food composition table quantities of each food items included in the food bundle were converted to the calorie equivalent. The reference food basket estimated is unlikely to add up to the recommended minimum calories (2200 calories). Therefore, the quantities of each food item in the bundle were proportionally scaled up by a constant factor to attain 2200 calories per day per adult equivalent.

In order to determine the cost associated with each poverty line, median prices based on internal price data for each item in the respective woreda were used. The food poverty line was constructed by calculating the cost of the adjusted food basket by multiplying by the median prices of each item in the reference food basket. Moreover, the consumption expenditure in each study area was expressed in terms of 2005/06 Endamokoni woreda prices .

To obtain the estimated cost of acquiring the calorie recommended daily allowance (RDA) that is, 2200 kcal per adult equivalent per day, this method regresses food energy intake (calorie) against total food expenditure per adult equivalent per annum. Accordingly, birr 1512 was found to be the minimum food expenditure per adult equivalent per annum required to meet basic needs (calorie recommended daily allowance). In this study food expenditure data was collected on a monthly basis, however, in order to calculate the food expenditure the data was scaled up to yearly basis.

Steps followed to measure household food Security using Food Energy intake method

According to Greer and Thorbecke (1986), Food energy intake method is one means of measuring household food security. The following specific steps were followed in order to calculate the threshold (cut off) point.

a) Total value of food consumed (Xj) by each household, which is equal to the sum of the value of purchased food (Vj) and the value of own production consumed (Kj),was determined:

Hence, **X j = Vj+Kj**

The value of purchased food consumed (Vj) by each household was established by multiplying the quantities of different food types purchased (Dij) by the prices per unit(Pij):

Vj = ΣDijPij

Where: Vj = Value of purchased food consumed by the jth Household

Dij = the quantity of the ith food items purchased by the jth household

Pij = the local price paid by the jth household for the ith item

The value of the own out put or donated food consumed by the household Kj is the product of own production including donation (Mij) and the local price (Pij).

The quantity Mij is the computed value of consumption.

Kj = ΣMijPij

b) The adult equivalent (Hj) for each household (The conversion scale is indicated in the appendix)

c) Total value of food consumed per adult equivalent was derived by dividing the total value of food by household adult equivalent

Kj = Xj/Hj

Where Xj = Total value of food consumed by jth household

Hj = Adult equivalent for jth household

Kj = Total value of food consumed per adult equivalent units

d) The different types and quantities of food consumed by the different households were converted to calories Cj .

e) A regression model was fitted to estimate parameters to be used in determining food poverty line (threshold point):

LnXj = a+bCj

Where: **Xj** = Total food expenditure per adult equivalent by household J

Cj = Total calorie consumption per adult equivalent by household J

a and **b** are parameters to be estimated.

f) The food poverty line, Z which is the estimated cost of acquiring the calorie recommended daily allowance (RDA) was estimated as

$Z = e(a+bR)$

Where Z = Food poverty line

R = Recommended daily allowance of calories per adult equivalent of 2,200

Accordingly, birr 1512 was found to be the minimum expenditure level to fulfill the recommended daily allowance.

CHAPTER FOUR

4. RESULT AND DISCUSSION

This part deals with the result of descriptive statistics and regression output of the empirical model. The analysis was made in the light of the objective of the study. Section 4.1 is about the descriptive analysis of the model variables. Section 4.2 deals about Hiryti-Mekan Seed producer and marketing cooperative. In section 4.3 about the result of the econometric analysis is presented.

4.1. Descriptive Statistical Results of the Model Variables

4. 1.1. Age of the household head

The average age of the sample household head is 47.71years where the minimum is 28 and the maximum is 72. The average household age of participants in using seed from SPC is 52.59 and the corresponding figure for non users 43.29. From the statistical analysis performed, it is found out that the mean age difference between users and non users is statistically significance.

Table 4.1 Ages of the Household Head

Description	Sample HH	treated	Non treated
Total	160	76	84
Mean	47.71	52.59	43.29
Minimum	28	29	28
Maximum	72	71	72

Source: computed from own survey, 2012.

4. 1.2. Household size

According to the study, the average household size of the total sample households in adult equivalent was 4.8 persons, with 1 and 8.83 being the minimum and the maximum household sizes respectively. When we compare the average household sizes between participants in SPC and non participants, the study revealed that households that participants in SPC have more household size than households that non participant in SPC. Average household size for users is 5.49 persons and 4.18 persons for non users. The mean comparison of household size between the two groups showed that there was a statistically significant difference in the mean household size at 1 percent probability level between users and non users

Table 4.2 Household size

Description	Sample HH	treated	Non treated
Total	160	76	84
Mean	4.8	5.49	4.18
Minimum	1	1.83	1
Maximum	8.83	8.83	8.5

Source: computed from own survey, 2012.

4. 1.3. Sex of the household head

According to the survey result, 11.25 percent of the sample households are headed by females and the rest 89.75 percent are headed by male. When we see the comparison by participation in using seed from SPC, out of the 100 participant's households 13.16 are headed by female and the corresponding figure for non users is 9.52. The chi square test showed that there is relation ship between sex of the household head and access to participate in using seed from SPC.

Table 4.3 Sex of the Household Head

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
Female	18	11.25	10	13.16	8	9.52
Male	142	88.75	66	86.84	76	90.48

Source: computed from own survey, 2012.

4. 1.4. Size of cultivated land

The land holding of the sample household varies from 0.25 ha to 2 ha. The average land holding is 0.84 ha. The mean land holding for users is 0.98 ha the corresponding figure for non users is 0.72 ha. The t-test revealed that mean difference between the two groups is statistically significant. It is quite true that in normal circumstances land size and land productivity are directly and positively related. Taking this into consideration finding in this also confirms that size of cultivated have its own influence in wheat production and participation in SPC.

Table 4.4 Size of cultivated land

Description	Sample HH	treated	Non treated	
Total	160	76	84	
Mean	.84	.98	.72	
Minimum	.25	.5	.25	
Maximum	2	2	2	

Source: computed from own survey, 2012.

4. 1.5. Livestock holding

The mean livestock holding in Tropical Livestock Unit (TLU) for the sample households is 3.87, where the minimum is 0 and the maximum is 7.8. Participants in SPC households have a better livestock holding than nonparticipant's households. The mean livestock holding for user households is 4.94 TLU and 2.91 TLU for non users. The mean comparison for the two groups showed that the difference between the groups with regard to livestock holding is statistically significant at 1 percent probability level. To communities where agriculture is main source of economic activity TLU has a significant influence on their agricultural productivity and on total amount of income received. This is confirmed by the result of the descriptive analysis in this paper

Table 4.5 Livestock holding

Description	Sample HH	treated	Non treated	
Total	160	76	84	
Mean	3.87	4.94	2.91	
Minimum	0	0.5	0	
Maximum	7.8	7.76	7.8	

Source: computed from own survey, 2012.

4.1.6. Ownership of radio

With regard to radio ownership, it was assumed that respondents who owned radio got information regarding to new technologies and agricultural market. The statistical result depict that 38.12% of the respondents responded that they have radio that helped them to get market information about their agricultural produce and inputs and 61.88 % of the respondents reply they do not have a radio or TV. From the participants in SPC 60.53 % have the access to radio or TV and only 39.47 % does not have. Those who are non participants in SPC 17.86 % have access to radio and TV but the remaining 82.14 % does not have. To see whether there is difference between each group of users and non users with

respect to ownership of radio Chi-square test was employed. As shown from the result the difference was not significant for all.

Table 4.6 Ownership of radio

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
NO	99	61.88	30	39.47	69	82.14
YES	61	38.12	46	60.53	15	17.86

Source: computed from own survey, 2012.

4. 1.7. Access to irrigation

According to the survey result, 73.75 percent of the sample households have the access to irrigation and the rest 26.25 percent does not have the access to irrigation. When we see the comparison by participants in SPC, out of the 100 % participant's households 88.16% have the access to irrigation and the rest 11.84 percent does not have the access to irrigation. If we see the non participants 60.71 % are irrigation users and 39.29% are non irrigation users. The chi square test showed that there is relation ship between participating in using seed from SPC and access to irrigation.

Table 4.7 Access to irrigation

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
No	42	26.25	9	11.84	33	39.29
Yes	118	73.75	67	88.16	51	60.71

Source: computed from own survey, 2012.

4. 2.8. Access to market

The mean distance to the market place in kilometer for the sample households is found to be 6.7 km with a minimum of 3 km and a maximum of 13 km. With regard to access to market, The statistical result depict that 68.75 % of the respondents responded that they have the access to market and 31.25 % of the respondents reply they do not have access to market. From the participants in SPC 31.25 % have the access to market and 15.79 % does not have. To see whether there is difference between each group of participants in using seed from SPC and non participants in using seed from SPC with respect to access to market Chi-square test was employed. As shown from the result the difference was significant for all.

Table 4.8 Access to market

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
No	50	31.25	12	15.79	38	45.24
Yes	110	68.75	64	84.21	46	54.76

Source: computed from own survey, 2012.

4. 1.9. Social leadership participation

Both participants in using seed from SPC and non participants expressed their opinion on the advantages of participation on leadership of social institutions. According to the survey result, 48.68 % of participants and 19.08 % of non participant farmers from the sample Woreda responded that they participate in social leadership. 51.32 % of participants and 80.95 % of non participant farmer's respondent express they do not participate. The chi square test showed that there is relationship between Social leadership participation household head and access to participate in using seed from SPC. Social relationship increases the frequency of discussion about development; enhancing communication for development. This is what the descriptive statistics result reveal, these who have opportunity of participating in social leadership are the once who have high participation in SPC, which could be effect of the discussion and communication they made while they gather to exhaust other social development agendas.

Table 4.9 social leadership participation

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
No	107	66.88	39	51.32	68	80.95
Yes	53	33.12	37	48.68	16	19.05

Source: computed from own survey, 2012.

4. 1.10. Access to credit service

The main source of credit in the study area are Dedebit microfinance and Freweyni saving and credit cooperative. From the sample households 68.12 percent get credit while 31.88 % do not take credit due to various reasons. The comparison by participants in SPC disclosed that 84.21 % users and 53.57 % non users take credit. From users 15.79 percent of the sample respondents and from the non user 46.43 percent households said that they don't want credit and the rest complained about high interest

rate. The chi square test result revealed that the relationship between access to credit and access to participate using seed from SPC is statistically significant.

Table 4.10 Access to credit service

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
No	51	31.88	12	15.79	39	46.43
Yes	109	68.12	64	84.21	45	53.57

Source: computed from own survey, 2012.

4. 1.11. Access to extension service

The study result showed that 77.5 percent of the sample households get extension service. When we compare participants and non participant households' majority of the participant households get support from extension agents when compared to non participants. According to the survey 86.84 % users and 69.05 % non users get extension service. Extension service here refers to advice, training, demonstration and distribution of input. 66 users and 58 non users consult extension agents when ever they need technical advice related with farming activity. From the respondent 13.16 % of the participants and 30.95 % non participants reply they do not get extension service. The chi square test indicated that there is significant relationship between access to participate in using seed from SPC and access to extension service.

Table 4.11. Access to extension service

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
No	36	22.5	10	13.16	26	30.95
Yes	124	77.5	66	86.84	58	69.05

Source: computed from own survey, 2012.

4.1.12. Training on wheat crop production

Even though there is a great difference among sample tabias, as it can be seen from (Table 12) from the total sampled farmers involved in wheat crop production only 22.5 % got training. Higher proportion of respondent to have training is reported participants 34.21 % and 11.9 % of Sample non participant farmers have got training on wheat crop production respectively. This is mainly due to the nature of crop production and the attention given by local government and NGOs involved in rural

development program in this Woreda. From the total sample non participants 88.10 % and 65.79 % of participants are not trained. The chi-squere result depict that, there was a significance difference between participants and non participants.

Table 4.1.12 Training on wheat crop production

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
No	124	77.5	50	65.79	74	88.10
Yes	36	22.5	26	34.21	10	11.90

Source: computed from own survey, 2012.

4. 1.13. Nearness to HIRYTI-MEKAN SPC from home

The average distance between the villages and the Hiryti-Mekan SPC in kilometer for the sample households is found to be 4.22 km with a minimum of .4 km and a maximum distance of 8.9 km.

According to the survey 38.16% users and 76.19 % non users assumes they are living far from Hiryti-Mekan SPC. Among the respondents 61.84% of participants in using seed from SPC and 23.81% of the non participants assumes they are living near to the SPC place. The chi-squere result depict that, there was a significance difference between participants and non participants.

Table 4.13 Nearness to HIRYTI-MEKAN SPC from home

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
Far	93	58.13	29	38.16	64	76.19
Near	67	41.88	47	61.84	20	23.81

Source: computed from own survey, 2012.

4. 1.14. Farmer's perception on HIRYTI-MEKAN SPC

As indicated in (Table 13) about 44.38 % of wheat producers perceived participating in using seed from SPC is good and the remaining 55.63 % perceived participating in using seed from SPC is not good. From those farmers participating in using seed from SPC 90.79% perceived participating is good and 9.21% perceived participating not well. Also from non participants 2.38 % perceived participating is good and 97.62% perceived participating not well. The chi-squere result depict that, there was a significance difference between participants and non participants.

Table 4.14 Farmer's perception on HIRYTI-MEKAN SPC

Description	Sample HH	%	treated	%	Non treated	%
Total	160	100	76	100	84	100
Not Good	89	55.63	7	9.21	82	97.62
Good	71	44.38	69	90.79	2	2.38

Source: computed from own survey, 2012.

4.2 Hiryti-Mekan Seed producer and marketing Cooperatives

4.2.1 Background of the cooperative

Formation of agricultural marketing cooperatives points out two major reasons: solve market failures and to address distortions in the supply chain (Nimble, 2005). Furthermore, Nimble (2005) stated that the need for formation of agricultural marketing cooperatives lies on the elimination of middle person (unnecessary profits in trade and commerce) and promotion of socio-economic well-being of their members, in the long run, among the people.

Though there are many agricultural cooperative structures in Ethiopia, the seed producer and marketing cooperative are located in few place of the country with help of universities and integrated seed sector development (ISSD). The establishment of those seed producer and marketing cooperative is a new concept but it is an essential area to be coordinated for obtaining the seed on time.

Hiryti-Mekan Seed producer cooperative is farmers' cooperative union organized with the aim of marketing seed and cereal crops. It is found in Tigray Region, southern zone, Endamokoni woreda. The cooperative was established in 2009 with above 60 members and now the members are only 59 of these 9 are female. The environmental condition of Endamokoni woreda is known to be good for varieties of products. However especially in Dega and kola areas of Tigray regioncereal food crops are produced in bulk Accordingly, Hiryti-Mekan Seed producer cooperative is established to easily contacting these market oriented cereal crops with customers and bring the desired market price to the producers The cooperative is also not only an agency for supplying seeds but also teaches the members the appropriate usage of seeds.

Hiryti-Mekan seed producer and marketing cooperative approach is required to obtain seed for the farmers because of the following reasons. Certified seeds are not available at the appropriate time in rural areas, this is because of Limited perception of individual farmers is not sufficient for the reputed

seed firms to deliver it and lack of technical know-how of farmers in handling, storing, and usage of seeds of HMSPC members. Therefore, need of establishing Seed producer and marketing cooperative have a great impact on farmers to organize themselves for obtaining the chief input of their cultivation. Hiryti-Mekan Seed producer cooperative gives a particular attention to cereals which include; wheat, barley, maize, Teff, sorghum, and soon. Accordingly, the Hiryti-Mekan Seed producer cooperative supplies improved seeds of the above listed crops to farmers in the study area.

4.2.2 Objectives of Hiryti-Mekan SPC

The main purpose of organizing the Hiryti-Mekan Seed producer and marketing cooperative is to ensure timely delivery of production inputs, i.e. seed and secure good quality seeds at a reasonable price. To ensure this, the cooperative assess in advance the entire need of farmer members as well as customers and prepare a time bound programme of purchasing and delivery for the entire operational area.

The cooperative can have the following objectives :

1. Borrow seeds from members as well as from others, for supplying to the members and to farmer who are interested to purchase.
2. Act as the agent for the joint supply of agricultural inputs and other requirements of the members, and joint sale of the produce.
3. Disseminate knowledge of the latest improvements in agriculture especially in seed technology, and
4. Encourage thrift, self-help and co-operation among the members.

4.2.3 Marketing system of Hiryti-Mekan SPC

The main marketing system of Hiryti-Mekan SPC are in two ways, to accept and to sell seeds from members, farmers or other agencies and supply these to the members, farmers and other agencies. The marketing system functions of the Hiryti-Mekan SPC are as under:

- Get seed inputs from members, farmers or other agencies and supply to the members on time;
-Lend adequate amount for production on any urgent need;
-Attract local savings from the people;
-Store the produce and seed of the members till it is sold or used for production;
-Identify the production needs of each farm household and assess their seasonal requirement of seed and other essential consumer items;
-Collect or purchase produce, where necessary, on behalf of a consumer's society and marketing society

4.2.3.1 Hiryti-Mekan SPC Marketing system for input Seed

Seed inputs supply is one of the valuable functions that HMSPC perform. This role of cooperatives is deemed to be very essential for the rural communities where such services are either missing and/or inadequate. Addressing the necessary farm inputs is inevitable in improving the productivity and income level of the farming communities, which in turn could improve the livelihood of the local community and promote the socio-economic development.
To address the demand of customers and members HMSPC have its own marketing system strategy. The strategy used for seed input is as follows

-selling from the stored or purchased quality improved seed gives priority to members and if there is surplus sell for willing customers
-the price for the seed should be the same as the Agriculture office soldl
-it is better if the seed is returned by kind(if a farmer takes one kilo gram wheat he should have to return it one kilo after production) but it is possible to pay in cash.
-it is possible to get credit without collateral
-the minimum requirement is to take for 0.25 hector (two “tsimad”)

In the focus discussion we made in the Tabia, some members and customers of the cooperative have noted that the marketing system have enabled them to use seed in willingness and also improve their expenditures, and enhance their livelihood. Hence, it is important to note that this has far reaching implication in boosting wheat crop production which intern promote the locality to size up on its competitive advantages, and there by trigger socio-economic development.

However, there are many problems and bottlenecks that Hiryti-Mekan Seed producer cooperative members and customers mentioned in relation to input supply. Members faced information gap or less awareness on successions of improved seeds to the climatic conditions of the area. Delay in the supply of inputs together with shortage of improve seeds is another chronic problem. Especially members in the cooperatives that produce twice a year mentioned that due to delay in delivery of improved seeds, harvesting of the first production season has been delayed and this followed interruption on the second season production. There has been also lack of communication and collaboration between supporters who deliver improved seeds.

Likewise there might be problem of logical, with the cooperative itself there might be sort of principal agent relationship, which affect the members and might lead to the having elite type of individuals who try to maximize their benefit at the expense of the other member. I know this is so huge but if

there is some hint, better you mentioned it so that there might be an opportunity of studying that by other students or the project at large. There was one conference related to this I have seen some of the farmers who talk a lot are benefiting better in different way.

4.2.3.2 Hiryti-Mekan SPC Marketing system Agricultural Outputs

Under the current free market situation, farmers have faced the difficulty of high competition in the market. To alleviate this difficulty, the introduction of Seed producer cooperative has become good than ever before. In the case of output market, the market share of cooperatives is very low due to shortage of finance, poor infrastructure, inadequate and poor quality warehouse, and weak entrepreneurship skills including business management, planning and financial management.

To avoid the problems mention above Hiryti-Mekan Seed producer cooperative are working in cooperation with Integrated Seed Sector Development (ISSD) project. The cooperative construct a ware house with its office class to avoid the problem. To eliminate the marketing challenges the cooperative also develop its own marketing system.

-for crop products produced in a quality way the cooperative will purchase it immediately after harvesting

-the crop product should be high quality

-the cash will be given after the product sold to Governmental institution

-the price for the purchased crop product will be minimum above one birr in kilogram

-farmers can deliver the amount they have

The product marketing role of Hiryti-Mekan Seed producer cooperative seems promising. Though the cooperative output marketing seems sluggish in some cases, the performance in other cases seems encouraging. For example in 2012 the cooperative purchase about 2,450 Quintal from members and non members.

Though there are still so many areas to be enhanced to be more competitive in the markets in the local area and the market opportunities available elsewhere in the country, the Hiryti-Mekan SPC have played encouraging roles in linking the producers directly with the market opportunity available by avoiding the middlemen who are considered to be basic contributors of unfair trade. However, the prevailing marketing capacity and network in these case areas are not yet well developed to their best levels.

4.2.4 Overall views on the roles of Hiryti-Mekan SPC

The below table is a summary of respondents' perception on overall achievement of Hiryti-Mekan Seed producer cooperative in the areas of access to credit service, access to inputs, access to market for output and access to asset building by local community.

Consequently, majorities of the respondents accounting about 48% disagree about cooperatives' role on provision of credit for local community and 2.5 % responds that they strongly disagree. While the remaining percentage share of 0.5% and 49 % was covered by those who were reacted the question with strongly agreement and agreement, respectively. With regard to the promotion access to inputs for the local community via the cooperatives, 60 % of the respondents disagree, 30 % agree and the remaining 7.5 %, 2.5 and of the respondents strongly disagree and strongly agree respectively. The greater percentage shares that constitute 46% & 44% are covered by those who were agree and disagree on cooperatives' role in promotion of access to market for outputs for the local community, respectively and 7 % strongly disagree and 3% strongly agree.

Table 4.15 Overall views on Hiryti-Mekan Seed producer cooperative role

Rating Factor For HMSPC	Strongly Disagree	Disagree	Agree	Strongly Agree
Provision of credit for the Local community	2.5	48	49	0.5
Promotion access to inputs for the Local Community	7.5	60	30	2.5
Promotion access to market for outputs for the Local Community	7	44	46	3

Source: computed from own survey, 2012.

Sample respondents faced different problems in relation to accessing agricultural inputs. The most basic of these problems include shortage and delay in supply of improved seeds miss conduct and embezzlement of appointed officials (Woreda rural development officials) e.g. embezzlement of prepaid money for improved seeds, and sell of improved seeds to traders in a higher price (Focus group discussion, held in simret and tahtay haya), and lack of communication and collaboration between supporters who deliver improved seeds.

4. 3. Econometric Analysis

4. 3.1. Detecting multicollinearity and outliers

One of the assumptions of the multiple regression models is that there is no exact linear relationship between any of the independent variables in the model. If such a linear relationship does exist, we say that the independent variables are perfectly collinear, or that perfect collinearity exists. Perfect collinearity is easy to discover because it will be impossible to calculate the estimates of the parameters. In practice the more difficult problem is having a high degree of multicollinearity. The variance inflation factors (VIF), the condition index (CI) and contingency coefficient are the most important tests to detect multicollinearity (Pindyck and Rubinfeld, 1991).

The study used the variance inflation factor to check for multicollinearity among continuous variables and contingency coefficient was used to check multicollinearity among discrete variables. According to the test result, multicollinearity was not a serious problem both among the continuous and discreet variables.

4. 3.2. Econometrics model of Impact Analysis (Heckman two-stage Model)

The econometric analysis for the Heckman two-stage procedure was performed using STATA version 12. Data were collected on 160 observations from Endamokoni woreda. There are different methods of impact evaluation of various program interventions among the participant and non-participant groups. However, for this study, we use the Heckman two stage methods to compute the difference in outcome of the Hiryti-mekan SPC institution among participants and non-participants on their wheat crop production.

The Heckman two-stage procedure was employed in order to control the selectivity bias and endogenity problem and obtain consistent and unbiased estimates. The Heckman model in the first stage predicts the probability of participating in using seed from Hiryti-Mekan SPC of each household, in the second stage it analyses the determinants of household wheat crop production.

4.3.2.1 Factors affecting program participation (Heckman selection model)

In this sub section, we treat results concerning wheat crop production at household level as well as the socio economic, demographic and other factors that affect the wheat crop production behavior of households. We used probit model of estimation to figure out factors having a certain sort of relationship to the program participants. The output for the Probit /participation/ equation shows that

five variables determine the probability of using seed from SPC. These are age of household head(hhage), access to irrigation (irrigation), social leadership participation (socialparticipa), access to extension service (extenservice),Tropical Livestock unit (TLU) and perception of the household head to the SPC(perception)

Age of Household head (hhage): the probit result shows that this variable has the expected negative sign and it is significant at 10 percent probability level. The reason for the negative relationship between household head age and participation in using seed from SPC might be that as the age of the household head increases, the household becomes conservative in participating on cooperatives and they will not willing to participate on SPC. The marginal effect indicates that when the household age increases by one year the probability of participating in using seed from SPC decreases by 9.5 percentage points.

Tropical Livestock unit (TLU): this variable shows positive relationship with household participation in using seed from SPC. It is significant at 5 percent probability level. The marginal effect of the variable shows that when a household increases its TLU by one Unit, participation in using seed from SPC will increase by 46.06 percentage points. The justification for this postive relationship could be, if the household head have many TLU it is possible to participate him or her self in the SPC. The main reasons are household head who have many TLU will have high income so it is easy for them to buy seed and other inputs.

Access to irrigation: this variable is significant at 1 percent probability level. It has a positive relationship with participation in using seed from SPC. The regression analysis shows that having access to irrigation has an influence on participation of participating in using seed from SPC. Households with access to irrigation could successfully produce much, because the familiarity of technology, if once farmers are familiar about better use of technology like irrigation then it is automatic, they can also use the seed. Second if there is access to water, there is less fear of risk-they might not have fear of shortage of water and less productivity but for these with out irrigation it is obvious lack of water might not encourage them to use better inputs like fertilizer or seed because it is high risky. This situation encourages them to participate in using seed from SPC. The marginal effect also confirms that access to irrigation increases the household's chance of participation in using seed from SPC by 78.78 percentage point.

Social leadership participation (socialparticipa):this variable postively influences participation in using seed from SPC of households. It is significant at 10 percent probability level. The postively relation ship indicates that households' heads who participate in social leadership might participate in different political and social meetings and training. More meeting, trainning and participating in field

visit and demonstration will help to the farmers participating on SPC. The marginal effect shows that for households head with participation in social leadership increase on participation of using seed from SPC by 56.63 percentage points.

Farmer's perception on HIRYTI-MEKAN SPC (perception): this variable showed a positive relationship with participation in using seed from SPC. It is significant at 1 percent probability level. The possible justification for the positive relation ship may indicate that in the study area, those households have a good perception on participating on using seed from SPC is willing to use seed from SPC easily. The marginal effect indicates that having a contact with extension agent increase the probability of participating in using seed from SPC by 98 percentage points.

The model output estimation result of the Binary probit model is depicted on Table 4.16.

Table4.16. Estimation result of the Binary probit model and its Marginal effect

variable	coefficient	P-value	Marginal effect	P-value
constant	6.906269	0.019	6.906269	0.019
hhage	-.2486704	0.009***	-.0954449	0.009***
familysize	-.2711313	0.463	-.1040659	0.463
hhsex	-.304122	0.704	-.111821	0.704
hhfarmsize	-.8003469	0.645	-.30719	0.645
TLU	1.148005	0.048**	.4406286	0.048**
ownermedia	-.1536978	0.895	-.0592283	0.895
irrigation	2.648354	0.005***	.7878191	0.005***
accessmkt	-.7965196	0.392	-.2838846	0.392
socialpart	1.850226	0.095*	.5663031	0.095*
accesstocredit	-.7464803	0.408	-.2682478	0.408
extentionservice	-1.041489	0.218	-.3436602	0.218
partrainning	-1.310813	0.260	-.4863611	0.260
nearnessSPC	.5280512	0.470	.1980239	0.470
perceptioncoopera	5.560221	0.000***	.9853398	0.000***
Dependent Variable		**Treated(participation in using seed from SPC)**		
Weighting variable		One		
Number of observation		160		
Likelihood function		174.21		
Degree of freedom		14		
Significance level		0.0000		
Source: Model output 2013				
Level of significance		Sign		
At 10 percent		*		
At 5 percent		**		
At 1 percent		***		

Source: computed from own survey, 2012.

4.4.2. Factors affect household wheat crop production (Heckman Outcome)

The wheat crop production has estimated according to the model put in the methodology part .We note that the dependent variable of the model is the wheat crop production. Hence, the regression coefficients measure the unit income change in wheat crop production for a unit change in the explanatory variable. Largely in all cases, the statistical significance of the various parameters differs widely across variables and the signs of the estimated variables are as anticipated with reasonable relative magnitudes. As it can be seen from the results of the different regression models Table 4.17, some are statistically significant at 1%, 5% and 10% level while others are not significant even at 10% level of significance.

In the selection /outcome/ equation of the model, seven variables are found to be a significant determinant of household wheat crop production. These are: age of household head (hhage), household size (famsize), size of cultivated land (hhfarmsize), Tropical Livestock ownership (TLU), participation in training(partrainning) access to extension service(Exsservice)and the inverse Mills ratio (LAMBDA).

Inverse Mills ratio (LAMBDA): According to the model output, the Lambda (inverse Mills ratio) term is significant at 5 percent probability level indicating the presence of selectivity bias. The positively sign suggests that the error terms in the participation and outcome equations are positively correlated. This shows that those unobserved factors that make the household participate in using seed from SPC are likely to be positively associated with household wheat crop production also.

Age of household head (hhage): Age of household head (hhage) is positively related with household wheat crop production contrary to the hypothesis we made. The variable is significant at 5 percent probability level. The positive and significant coefficient of age of household head reveals that household head with high age produce wheat crop production Good. The result go inline with the conclusion of Bahadur (2004), the reason for the positive relationship between household head age and wheat crop production might be that as the age of the household head increases, the household experience in production also increase. The coefficient of the variable indicates that as the household head age increases by one year the wheat crop production of the household increase by Birr 59.09.

Household size (famsize): household size is positively related with household wheat crop production. The variable is significant at 1 percent probability level. The positive and significant coefficient of household size reveals that larger household size leads to high wheat crop production. This means, as household size increases there are many labor in the household to share a wheat crop production,

better use of seed, intensive cultivating of land and high productivity. We might assume that there are two extreme cases where the household size becomes large, the first extreme is very poor household heads tend to have larger household size since poor people have the incentive for high fertility to increase the number of potential income earners in the household and to provide for old age security (Smith, 1997).The coefficient of the variable indicates that as the household size increases by one adult equivalent the wheat crop production of the household increases by Birr 653.38

Size of cultivated land (hhfarmsize): the regression result shows that this variable has the expected positive sign and it is significant at 10 percent probability level. As the cultivated land size increases, the household becomes able to increase and diversify the quantity and type of crop produced on the cultivated land; this may in turn imply increased wheat crop production. The coefficient of the variable shows that as the household gets one more hectare of land wheat crop production of the household increases by Birr 1478.69 and this may lead to improved income from household wheat crop production. This result is consistent with the finding of Mulugeta (2002) Ayalew (2003).

Tropical Livestock ownership (TLU): this variable is statistically significant at 5 percent probability level. The positive relationship indicates that households with larger livestock holding may have the opportunity to plough at any time with minimum labor cost, especially for oxen. The coefficient of the variable shows that as the household gets one more TLU wheat crop production of the household increases by Birr 538.18 and this may lead to improved income from household wheat crop production.

Access to Extension Service (extentionservice): access to extension service is positively related with household wheat crop production. The variable is significant at 5 % probability level. The positive and significant coefficient of access to extension reveals those households who have many contacts with extension agent have high wheat crop production. The possible justification for the positive relation ship may indicate that in the study area, those households who get technical advice, training or those who participated on field demonstrations are well aware of the advantage of using seed from SPC and produce more, thereby improving the household wheat crop production. The coefficient of the variable indicates that as the household size increases by one adult equivalent the wheat crop production of the household increases by Birr 452.54. This result is consistent with the finding of Abebaw (2003), and Yilma (2005).

Participation in training (partrainning): this variable is statistically significant at 10 percent probability level and has the expected positive sign. According to (Edlu, 2006), Participation in training will enable farmers to get more information and improve their understanding about the available packages, which may intern lead to a change in their knowledge, attitude and behavior. The coefficient of the variable indicates that households participate in training increase their wheat crop production by Birr 190.18 than those households that do not have access to participate in training. The model output for estimation result of the outcome equation model is depicted on Table 4.17.

Table4.17. Estimation result of the outcome Equation model and its Marginal effect

variable	Coefficient	p-value	Marginal effect	p-value
constant	-215.603	0.727	-215.603	0.727
hhage	59.09498	0.011**	59.09498	0.011**
familysize	653.3814	0.000***	653.3814	0.000***
hhsex	-42.24766	0.817	-42.24766	0.817
hhfarmsize	1478.697	0.003***	1478.697	0.003***
TLU	538.1823	0.026**	538.1823	0.026**
ownermedia	-20.93434	0.922	-20.93434	0.922
irrigation	171.2954	0.505	171.2954	0.505
accessmkt	163.0168	0.508	163.0168	0.508
socialpart	-110.8782	0.563	-110.8782	0.563
accesstocredit	-368.3195	0.126	-368.3195	0.126
extentionservice	452.5487	0.019**	452.5487	0.019**
partrainning	510.2993	0.004***	510.2993	0.004***
Near	-302.9527	0.164	-302.9527	0.164
LAMBDA	245.2057	0.043**		
Dependent Variable		Wheat crop production in birr		
Selection rule is		Participant=1		
Number of observation		160		
Likelihood function		36.56		
Pro value		0.000		
R-squared		0.588		
Rho		0.55559		
Source: Model output 2013				
Level of significance		Sign		
At 10 percent		*		
At 5 percent		**		
At 1 percent		***		

Source: computed from own survey, 2012

Table 4.18 Outcome equation

wheatcrop~01	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**
treated	**1637.48**	**475.581**	**5.55**	**0.000**	**1698.17 3576.802**

Source: computed from own survey, 2012

Following the above result the study also runs the Ordinary Least Square (OLS) model to compare the result of the estimate with the Heckman two- step procedure. As expected the model result identified that age of household head (hhage), household size (famsize), size of cultivated land (hhfarmsize), Tropical Livestock ownership (TLU), extension service, training and perception of the farmers on HMSPC are significant determinant of household wheat crop production. But the size of the coefficient for the Heckman two-step procedure is about higher than that of the OLS regression outcome result. Thus, using OLS regression model underestimates the impact of access to participate in using seed from SPC to wheat crop production.

Moreover, the Role of seed producer and marketing cooperative on the treated households is also a point of concern in this study. For that matter, Heckman two stage outcome results revealed that the treated group households have on average 1,637.48 more than the control group in wheat crop production by birr per year. The reason for having better production is farmers participating in using seed from this cooperative gets credit, they also get a better improved seed or the basic seed which comes from researchers like Mekele University and Tigray agricultural institute. Participating in Hiryti-Mekan SPC has also additional advantage like training, field visit and demonstration.

To sum up, the overall evaluation of the study conferred that by the wheat crop production and implication on food security, the treated groups are in better position than the control group. This implies the seed producer and marketing cooperative has significant effect in the peoples of Tabia Mekan both in wheat crop production and food security as compared to the control group. As it is shown in the above paragraphs farmers who are participating in this SPC are obtaining better benefits, indicated not only by their access to seed from this SPC but also in securing better marketability for their product; they can sell their product though this SPC with out mediator and they have also the advantage to make a relation ship like a relative.

4.3 Role of SPC to food security

4. 3.1 Food shortage months of the households

The survey result disclosed that participants in using seed from SPC are better than non users with regard to securing the household with sufficient food based on both their food consumption months and the monthly Household food consumption food poverty line 126 birr. The survey showed that 17 percent of non users face food shortage during some months of the year. Specially, September is the most serious food shortage month for non users, 18.8 percent of the non users face the problem in September. August, October and July are also identified to be months of insufficient food with 16.25 percent, 15.5 percent and 14 percent of households respectively facing the problem.

This may be because non users are producing by using traditional seed which has low productivity and they may also buy the price of inputs on higher than hiryti-mekan price. In the case of users, they can produce using improved seed with high productivity, fair price and having access to credit from SPC. Some of the users also face food shortage problem that is, 5.29 percent of them reported food shortage in October, 4 percent in August and 4.7 percent of them in September (Table 4.19).

Table 4.19. Food shortage months

Food shortage months	participant	Non-participant
June	0	0.5
July	4.0	14
August	4.0	16.25
September	4.7	18.5
October	5.3	15.15
November	1.5	4.0

Source: survey result(2012)

4. 3.2 coping strategies of households

Households in the study area have various coping mechanisms during crop failure. The survey showed that household's participating in using seed from SPC has a better coping strategy than the non users. None of the users search for off farm employment as a coping strategy. On the other hand 3.5 percent of non users join off farm employment during bad times as a coping mechanism.

Sales of small animals are the major coping strategy in the study area, 34.2 percent of the users and 38 percent of the non users sell animals to pass bad years. Taking credit is also the other way of coping mechanism, 15.5 percent of non users and 8 percent of users employ this strategy. Cattle selling is also a coping strategy in the study area, 12.5 percent of the non users and 5.5 percent of users apply this strategy (Table 4.20).

Table 4.20. coping strategies of the household

coping strategies	participant	Non-participant
Cattle selling	5.5	12.5
Reducing meal	0	0
Sales of small animals	34.2	38
Off farm employment	0	3.5
Taking credit	8	15.5

Source: survey result(2012)

4.3.3 Food security status of households

The study grouped households into food secure and insecure based on their access to participate in using seed from SPC. The survey result disclosed that participants in using seed from SPC are better than non users with regard to securing the household with sufficient food based on the monthly Household food consumption food poverty line 126 birr and the yearly food poverty line 1512.00. According to the output food poverty line calculated using food Expenditure of ETB 126.00 per adult per month respectively. Aligned to Food poverty line, on average 11.63% of the sample population in study area is unable to meet the stipulated minimum level of caloric intake i.e., 2,200 kcal per adult equivalence per day. From the total sample household, 14.28 percent of the non users and 6.57 percent of users are found to be food insecure respectively and 85.72 percent of non users and 93.43 percent of the users are food secure. Generally out of the 160 sample households 89.37 percent of them are food secure and 11.63 percent of them are food insecure. This classification is made on the basis of the calculation done to measure household food security. However, access to participate in using seed from SPC is only one of the many other variables that influence the food security status of households.

CHAPTER FIVE

5. SUMMARY AND Policy Implication

This section summarizes the major findings of the study and proposes recommendations for policy purpose. Section 5.1 is Summary of major findings and Section 5.2 is Policy Implications.

5.1. Summary of Major Findings

This paper aims to analyze the Role of seed producers' cooperatives on Endamokoni woreda, Tigray regional state particularly on wheat crop production and its implication to food security. In the choice of parameters covered in the analysis, we were guided by sound theories and the data derived from household survey in October and November, 2012. In the descriptive analysis of the data set indicates the sample survey involved a total of 160 sample households 76 households from the participants in using seed from SPC and 84 households from the non participants group. Comparing among groups the high share take by control group which accounts 52.5 % and the share of treated group 47.5 %.

To carry out this research, one Woreda and one crop (wheat) was selected based on different reports, discussion with professionals and researchers experience in the region. Then from this Woreda 3 Tabias were selected based on their relative potential and accessibility. From this woreda 160 sample farmers were randomly selected for interview. In addition to interview of sample farmers using survey questionnaires, different quantitative and qualitative information were collected from different organizations and group of farmers in order to have clear vision of the situations.

In order to describe and compare different categories of the sample units with respect to the desired characteristics, mean, standard deviation and percentage were computed. A t- test was also performed to statistically compare the mean difference between the two groups with regard to these variables and a statistically significant result is obtained. The chi square test also reveals that variables like access to extension service, access to credit and access to irrigation have significant relation ship with access to participate in using seed from SPC.

The descriptive analysis also compares the mean of the two groups by using different determinants of household wheat crop production. The result revealed that households participating in using seed from SPC are in a better position when compared to those that are non users. The descriptive statistics reveals that households with access to participate in using seed from SPC face food shortage in only few months of the year while non users suffer from critical food shortage in August September and October. The survey revealed that households in the study area have various coping strategies during months of food shortage. Sales of small animals, sales of cattle, off farm employment and credit are some of the strategies.

Multivariate analysis is performed using the Heckman two- stage procedure. The Heckman two –stage procedure is implemented in order to capture the selectivity bias and get the Role of seed producers' cooperatives on wheat crop production and its implication to food security. Moreover, the first stage of the model removes the problem of endogenity since it considers participation in using seed from SPC as a dependent variable.

In the first stage of the Heckman two-stage procedure the following variables determined participation in using seed from SPC: age of household head, access to irrigation, social leadership participation, access to extension service, TLU, perception of household head to the SPC.

In the second stage of the Heckman two-stage procedure the lambda term which confirms the presence of self selection was significant indicating the presence of selectivity bias. After the model corrects for the bias due to some unobservable factors, age of household head, household size, size of cultivated land, Tropical Livestock ownership, participation in training, access to extension service and the inverse Mills ratio are found to determine household wheat crop production.

Ordinary least square estimation is also performed to compare the coefficients of the variable access to participation in using seed from SPC with the Heckman two-stage procedure and it is found out that the size of the coefficient of the variable access to participation in using seed from SPC Heckman two-stage is higher than that of the coefficient of the OLS estimate indicating that the OLS model outcome result underestimates the Role of seed producer and marketing cooperatives on wheat crop production and its implication on food security.

Hiryti-Mekan SPC is farmers' cooperative union organized with the aim of marketing seed and cereal crops. Its main purpose is to ensure timely delivery of production inputs, i.e. seed. The main marketing systems of Hiryti-Mekan SPC are in two ways, to accept and to sell seeds from members, farmers or other agencies. Some members and customers of the cooperative have noted that the marketing system have enabled them to use seed in willingness and also improve their expenditures, and enhance their livelihood. To eliminate the marketing challenges the cooperative also develop its own marketing system. Majorities of the respondents disagree about cooperatives' role on provision of credit for local community. With regard to the promotion access to inputs for the local community via the cooperatives, most of the respondents also disagree about 60 %.The greater percentage shares that constitute 46% & 44% are covered by those who were agree and disagree on cooperatives' role in promotion of access to market for outputs for the local community.

Regarding the food consumption expenditure of households, the mean food consumption expenditure of treated groups is still significantly higher than non-treated group. The total ratio of monthly food consumption expenditure to adult equivalent is above126 birr for the treated which is above the poverty line but most of the non treated they lie below the food poverty line. The reason for treated to become food secure is, farmers who are participating in this SPC are advantageous not only by using seed from this SPC but also they can sell their product though this SPC with out middle man and they have also the advantage to make a relation ship like a relative. So they can get a good price for their out put as well as they can also increase their productivity through those highly improved seed.

To summarize, under the food security analysis and outcome estimation, the treated groups are better than the non treated groups. This implies the seed producers' cooperative has giving significant effect in the peoples of Mekan village in production of wheat crop production and food security as compared to the control group. But the introduction of this seed producers and marketing cooperative is almost only for three years. So this might not be the only factor which makes the participation to have high production of wheat crop.

5.2. Policy Recommendations

To assure food security and reduce poverty increasing agricultural productivity using modern agricultural input plays a vital role. Among the important agricultural inputs, seed takes the first place. To improve the use of improved seed, ensuring the supply of standard quality at the required quantity, at the right time and at fair price is decisive. Under the current condition, the seed demand of the region is not satisfied due to the limited number of private seed companies, seed producer cooperatives and the public seed company. Because of this demand deficit farmer producing wheat crop and other cereals are not getting improved seed for their production.

Different literatures worked in developing countries including Ethiopia emphasized on farmers based crop production as the main alternative for seed source, food consumption and marketing to make a better life for the peasants. Moreover, wheat crop production can be considered as a means to generate additional income or even an alternative to specialize as income generating activity because it can be as input for factories.

This SPC has its own work office and ware house with a support of ISSD. But according to the information gathered from the members there is a limited capacity to increase their participating members. Information and awareness creation on the issue of seeds are favorable to the locality, timely and sufficient delivery of improved seeds, facilitating the communication and collaboration of all

stakeholders in delivery of improved seeds, and better and continuous researches on improving seeds are among the forwarded solution by the respondents.

Lack of warehouse/store houses, time gap between demand of market and market availability, market inadequacy, and lack of modern grading machines to deliver quality produce are the major agricultural output market access related problems encountered by the members of Hiryti-Mekan Seed producer cooperative. The possible measures to tackle these problems include; organizing the team for tackling warehouse problems, improving the bargaining power to decide on price of produce, acquiring modern grading machines and creating well established channel up to the central markets.

The cooperatives should take actions by building their capacity especially in the areas of technical personnel, offices, warehouse and machineries, diversification of service delivery, participation in social affairs, consistent/regular and sufficient delivery of returns and improving the awareness of members through education, enabling to diversity income generation in order to play the role of local capital accumulation or asset building. The marketing system the cooperative implementing is favorable for the participants so it should have to continue in strong mechanism.

In the first stage of the Heckman two-stage procedure the following variables are found to determine participation in using seed from SPC: age of household head, sex of household head, access to irrigation, social leadership participation, TLU, perception of the household head to the SPC.

Age of household head affects participation of household in participation of using seed from SPC positively. In order to solve the problems related with age, Hiryti-mekan SPc should have to train for farmers at every group of age specially adults. Because persons who are more aged will be convinced if they have got chance to observe the promotion of SPC at high level. The *woreda* office of agriculture and rural development bureau also work on promoting and strengthen the Hryti-Mekan SPC.

Ownership of Tropical Livestock Unit is the second variable that positively affects participation in using seed from SPC. So as we see from the survey result household with high ownership of TLU means they have a good income. So in order to attract more for household who have more TLU, The HMSPC should have to give priority to those farmers who have more TLU are willing. If they have got the information about the cooperative they will not fear to try and use seed. In order farmers to increase their TLU government should have to give credit in different mechanisms.

Access to irrigation is positively related to participating in using seed from SPC. The positive relation ship indicates that households in the study area having access to irrigation contribute to participate in using seed from SPC. This could be through producing of wheat crop, other cereal and vegetable twice

in a year. The production through irrigation will generate them income which makes them possible to use seed from any market including the SPC. Therefore by giving training how to use agricultural technologies from SPC and by what mechanism they will get the seed and other technologies, households could generate more income and improve their financial status.

Social leadership participation variable positively influences participation in using seed from SPC of households. The positively relation ship indicates that households' heads who participate in social leadership might participate in different political and social meetings and training. More meeting, training and participating in field visit and demonstration will help to the farmers participating on SPC. The social status having responsibility in society should be always used for development purpose, talking about conservation, better technology utilization, reducing poverty, and achieving progress or development, it is called communication for development. Recommend that social leadership should be use not only to handle societal matters but also development issues. So the SPC should have to try participating persons who are participants on social leadership in order to get an experience from them.

Farmer's perception on HMSPC variable showed a positive relationship with participation in using seed from SPC. The possible justification for the positive relation ship may indicate that in the study area, those households have a good perception on participating on using seed from SPC is willing to use seed from SPC easily. The marginal effect indicates that having a contact with extension agent increase the probability of participating in using seed from SPC by 98 percentage points. To build Farmer's perception on HMSPC it is recommend that giving training and work on promotion will increase to farmer's perception on HMSPC likewise provision of better training to extension agent can enable them to reach out farmers in better manner.

In the second stage of the Heckman two-stage procedure the following variables significantly determine household wheat crop production: age of household head, household size, size of cultivated land, Tropical Livestock ownership, access to extension service and participation in training.

Age of household head is found to be a significant determinant of the household wheat crop production. As it is shown from the result age of household head affects negatively to the wheat crop production. Therefore, by keeping the youth participants, the SPC and office of agriculture and rural development should have to work more to participate all groups age of farmers because they will get a benefit from this SPC.

Household size is found to positively determine household wheat crop production. Households with larger household size are able to meet high wheat crop production. Therefore, the introduction of new

ideas especially which are related with cottage and small scale industries at rural level will help those families to reduce the idol labor of the family. If those family members help other than wheat crop production they will be also source of income for the family which indirectly helps the participation of purchasing seed and other input for production of wheat and other cereals. So farmers having many household sizes should get training how to use intensive farming in order to get high crop production.

Size of cultivated land and household wheat crop production are positively related indicating larger farm size improves household wheat crop production. Households with large farm size are found to be high wheat crop producer. However, there may not be a possibility of expanding cultivated land size anymore because of increasing family size and degradation of the existing farm land. Therefore, household must be trained as to how to increase production per unit area (productivity) through intensive farming.

Access to extension service is positively related with household wheat crop production. The positive and significant coefficient of access to extension reveals those households who have many contacts with extension agent have high wheat crop production. The possible justification for the positive relation ship may indicate that in the study area, those households who get technical advice, training or those who participated on field demonstrations are well aware of the advantage of using seed from SPC and produce more, thereby improving the household wheat crop production. So HMSPC should have to work more with Extension agents in order to get more participants. Therefore the HMSPC management committee should always make contact with the DAs.

Ownership of Tropical Livestock is found to be significant determinant of the household wheat crop production. Household with large ownership of TLU gets high wheat crop production. Moreover improving ox ownership found to have positive contribution to increase wheat crop production. Therefore efforts aimed at promoting wheat crop production by farmers should take the importance of additional finance to wheat producer farmers for purchase of farm oxen including input other TLU or encouraging them to participate in off farm that can be a good way to increase farm technologies and farm inputs.

This study also signifies training play a key role in wheat crop production positively. The transfer of knowledge and information concerning wheat and cereal production including training that could develop the skill of farmers found important to increase the number of willing farmers in wheat crop production. On the other hand, those who lack information and knowledge besides the skill to produce required wheat crop were reluctant to involve in this production, which clearly indicate the need of improvement in training system and particularly letting established SPC in the rural area to give continuous and standard training to the farmers.

There are many rural poverty reduction programs going on rural area of Tigray. However, their effect on food security is higher in some area while less than the expectation in somewhere else. The reason for this success and failure has depended on a lot of factors. Among the main reasons, the potential resource of that area and the commitment to implement the programs by principal agents. In the study area among the development programs introduce by the office of agriculture, HMSPC is introducing technologies like supplying improved seeds. Farmers using improved seed from this SPC are getting high production and securing their food security. Therefore the administration of this woreda as well as the office of agriculture development should have to support this SPC to increase its participants.

In some households the source of food insecure might differ one from the other, so intervene at community level might not enough to see immediate effect on the household with reducing food poverty and to increase crop production. The Hiryti-Mekan SPC is working to meet the goals which are increasing crop production of those participants and to insure food secure of member and participant household. The intervention of this cooperative is at tabia level which is supported by Integrated seed sector development and this SPC may show an impact on crop production and food security. However, the effect is not as much as it was expected. Still above 40% of the participants are not fully using seed from every kind seed from the SPC.

Following the above conclusion the researcher may not conclude totally the SPC has Changing the livelihood of village. We try to show the role of the seed producers and marketing cooperatives and its role in improving wheat production of the beneficiaries but it is not working fully in the village to address all the farmers but in a better way and position when we compare with no seed producer and marketing cooperative villages. Therefore the cooperative is benefiting to participants and members of the SPC but it is better if the seed producer and marketing cooperative revise its marketing system, credit system and membership registration.

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APPENDICES

The interview schedule

Title: The Role Of Seed Producer And Marketing Cooperative On Wheat Crop production And Its Implication To Food Security.

(The Case Of Endamokhoni Woreda, Tigray, Ethiopia)

General Instructions to Enumerators

i. Make brief introduction to the respondent before starting the interview (greet them, tell your name, get her/his name, and make clear the purpose and objective of the study that you are undertaking).
ii. Please ask the question clearly and patiently until the respondent understands.
iii. During the process put the answers of each respondent both on the space provided and encircle the choice or tick mark as required

General information

Date of interview:_____

1. Name of the respondent:_____ HH ID _____

Male/Female:_____; Age:_____years; years of education:_____

Kushet_____; Village (Tabia)_____;

District _____; Province/Zone/Region:_____

Mobile Number: Country code: _____; Mobile Number:_____

2. Name of the Interviewer:_____Sign:_____

_____

Mobile # with country code: _____

Part one: Household Demographic status

Religion:_____

Ethnicity:_____

#	Name	Age(Years)	Sex 1=Male2=Female	Education level [1] illiterate; [2] religious education [3] adult education;	Skill	Relationship to the respondent	Occupation: [1] education; [2] farming own land; [3] labor for other farmers; [4] non-farm casual work;	Is the member available for work on the household farm? [a] full time; [b] part time; [c] not at all
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

1. Household head experience (participation) in using wheat seed from Mekan-SPC in years ------
2. Do you face labor shortage problem in wheat crop production? 1) Yes 2) No
3. If yes, how do you solve labor shortage problem?
   1) By hiring 2) Asking for cooperation (Debo/) 3) All 4) Others (Specify) -------
4. Fathers education 1) literate 2) illiterate
5. Mothers education 1) literate 2) illiterate
6. Does your father member of Mekan-SPC 1) yes 2) no
7. Does your Mother member of Mekan-SPC 1) yes 2) no
8. Have you ever been member of in any cooperative 1) yes 2) no

Part Two: Infrastructure/access to road and participation in using seed from SPC

2.1 Distance from the main asphalt road (in km) ----------

2.2 Distance from the market place (in km) ----------

2.3. How do you transport agricultural produce to the market place?

1. on back --------- 3. Horse cart ----------
2. Vehicle---------- 4. Other specify---------

2.4. Access to participation in using seed from SPC (Put √ mark)

1. User---------- 2.Non user----------

2.5 Reason for not participate in using wheat seed from SPC

1. No access
2. There are no enough products
3. No information about input in the Mekan-SPC
4. It has low quality
5. It has high price
6. The SPC have far distance from home

Part Three: Mekan-SPC contribution towards wheat crop production

3.1 Do you think that participation in using seed from SPC has a positive impact on wheat crop production? (Put √ mark)

1. Yes---------- 2. No----------

3.2 If your answer is yes, what are the positive impacts of participation in using seed from SPC that you have seen? (Put √ mark)

1. Increased agricultural production-------
2. Increased household income-----
3. Access to input credit---
4. Other specify-----

3.3. How many times do you produce within a year?

1. before adoption of participation in using seed from SPC ------
2. after adoption of participation in using seed from SPC -------

3.4. What change (s) did you see as a result of double or triple cropping?

3.5. The household income Source before participation in using seed from SPC (put √ mark)

1. Sales of vegetables------ 2. Wage ---------
3. Rent of own land ------ 4. Sales of cereals------
5. Others, Specify-------

Part Four: Mekan-SPC contribution towards Household food security

4.1 Do you think that participation in using seed from SPC has a positive impact on household food security? (Put √ mark)

1. Yes---------- 2. No----------

4.2 If your answer is yes, what are the positive impacts of participation in using seed from SPC that you have seen? (Put √ mark)

1. Increased agricultural production-------
2. Increased household income-----
3. Access to input credit---
4. Other specify-----

4.3. During which month (s) are food shortages severing? Choose according to their severity level? (give rank ie for the most severe month put 1 then 2etc)

October---- November---- December---- January---- February---- March---- April---- May---- June---- July---- August---- September----

4.4. How do your households used to cope during crop failures? (put √ mark)

1) Sale of livestock----- 3) Sale of Animals-----

2) Reduce the number of meals---- 4) Wage employment----

5) Other specify----

PART FIVE: Access to and utilization of farm inputs for wheat crop production

5.1 Which agricultural inputs do you use for wheat crop production and what are the sources?

Type of input	Specific Name	Source(tick)		
		Market	BoARD	Mekan SPC
Improved seed of wheat				
Local seed of wheat				
Fertilizer				
Chemicals				
Others(Specify)				

5.2 Quantity of inputs purchased /used for wheat crop production and their price in 2003E.C(from Mekan-SPC)

Type of inputs	Specific name	Quantity purchased/used	Unit price(Birr)	Total cost
Improved wheat seed				
Local seed of wheat				
Fertilizer	DAP			
	Urea			
Chemicals	Herbicide			
	Fungicide			
	Insecticide			
Others (Specify)				

5.2.1 Quantity of inputs purchased /used for wheat crop production and their price in 2003E.C(from market)

Type of inputs	Specific name	Quantity purchased/used	Unit price(Birr)	Total cost
Improved wheat seed				
Local seed of wheat				
Fertilizer	DAP			
	Urea			
	Fungicide			
	Insecticide			
Others (Specify)				

5.2.2 Quantity of inputs purchased /used for wheat crop production and their price in 2003E.C(from BoARD)

Type of inputs	Specific name	Quantity purchased/used	Unit price(Birr)	Total cost
Improved wheat seed				
Local seed of wheat				
Fertilizer	DAP			
	Urea			
Chemicals	Herbicide			
	Fungicide			
Others (Specify)				

5.3 Can you purchase the required amount of inputs as you need (Availability)?

- From market 1)Yes 2) No
- From BoARD 1)Yes 2) No
- From Mekan-SPC 1)Yes 2) No

5.3.1 If, No please rate the availability on the following five-point scale (From Market)

Inputs	Availability Rating				
	Very scarce(1)	Scarce(2)	Not as required(3)	Available(4)	Very much available(5)
Improved wheat seed					
Local seed of wheat					
Fertilizer					
Chemicals					
Others(Specify)					

5.3.2 If, No please rate the availability on the following five-point scale(From BoARD)

Inputs	Availability Rating				
	Very scarce(1)	Scarce(2)	Not as required(3)	Available(4)	Very much available(5)
Improved wheat seed					
Local seed of wheat					
Fertilizer					
Chemicals					
Others(Specify)					

5.3.3 If, No please rate the availability on the following five-point scale (From Mekan-SPC)

Inputs	Availability Rating				
	Very scarce(1)	Scarce(2)	Not as required(3)	Available(4)	Very much available(5)
Improved wheat seed					
Local seed of wheat					
Fertilizer					
Chemicals					
Others(Specify)					

5.3.3.1 What do you recommend to Mekan-SPC about the supply of input they provide to market?

5.4 Can you get the required inputs on time?

- From market 1)Yes 2) No
- From BoARD 1)Yes 2) No
- From Mekan-SPC 1)Yes 2) No

5.4.1 If No, please rate the timely availability of the inputs on the following five point scale(From Market)

Inputs	Rating of timely availability				
	Never on time(1)	Rarely on time(2)	Some times on time(3)	Mostly on time(4)	Always on time(5)
Improved wheat seed					
Local seed of wheat					
Fertilizer					
Chemicals					

5.4.2 If No, please rate the timely availability of the inputs on the following five point scale(From BoARD)

Inputs	Rating of timely availability				
	Never on time(1)	Rarely on time(2)	Some times on time(3)	Mostly on time(4)	Always on time(5)
Improved wheat seed					
Local seed of wheat					
Fertilizer					
Chemicals					

5.4.3 If No, please rate the timely availability of the inputs on the following five point scale (From Mekan SPC)

Inputs	Rating of timely availability				
	Never on time(1)	Rarely on time(2)	Some times on time(3)	Mostly on time(4)	Always on time(5)
Improved wheat seed					
Local seed of wheat					
Fertilizer					
Chemicals					

5.4.3.1 What do you recommend to Mekan-SPC about the timely availability of the inputs supply they provide to market?

5.5 Do you get the inputs to the required quality?

- From market 1)Yes 2) No
- From BoARD 1)Yes 2) No
- From Mekan-SPC 1)Yes 2) No

5.5.1 If No, please rate the quality of the inputs available on the following five point scale?(From Market)

Inputs	Quality Rating				
	Very poor(1)	Poor(2)	Moderate(3)	Good(4)	Very good(5)
Improved wheat seed					
Fertilizer					
Chemicals					
Others(Specify)					

5.5.2 If No, please rate the quality of the inputs available on the following five point scale?(From BoARD)

Inputs	Quality Rating				
	Very poor(1)	Poor(2)	Moderate(3)	Good(4)	Very good(5)
Improved wheat seed					
Fertilizer					
Chemicals					
Others(Specify)					

5.5.3 If No, please rate the quality of the inputs available on the following five point scale?(From Mekan-SPC)

Inputs	Quality Rating				
	Very poor(1)	Poor(2)	Moderate(3)	Good(4)	Very good(5)
Improved wheat seed					
Fertilizer					
Chemicals					
Others(Specify)					

5.5.3.1 What do you recommend to Mekan-SPC about the quality of the inputs available they provide to market?

5.6 Which of the following problems do you think are there with inputs provided by rural development office?

Inputs	Problems (tick)					Remark
	Scarcity	Not timely	Low Quality	Expensive	Down payment	
Improved wheat seed						
Fertilizer						
Others(Specify)						

5.7 Which of the following problems do you think are there with inputs provided by Mekan-SPC?

Inputs	Problems (tick)					Remark
	Scarcity	Not timely	Low Quality	Expensive	Down payment	
Improved wheat seed						
Fertilizer						
Others(Specify)						

5.8 How much does the timeliness of availability of inputs from Mekan-SPC affect your level of input participation (adoption)? (Tick)

No effect(1)	Affected less(2)	Somewhat affected(3)	High effect(4)	Very high effect(5)

5.9 Have you obtained credit to purchase wheat seed in the last five years?

1) Yes 2) No

5.10 If yes, from where you get and how much did you get?

Source----------

Amount (in Birr) ----------

5.11 For what purpose did you use the credit?
1) For purchasing fertilizer 2) For purchasing improved seeds 3) For purchasing chemicals 4)
For other purpose (Specify) ----------
5.12 Have you obtained credit to purchase(use) wheat seed from mekan-cooperative in the last two years?
1) Yes 2) No
5.11 If yes, how much did you get?
Source----------
Amount (in Birr) ----------

PART SIX: INCOME FROM AGRICULTURAL PRODUCTIVITY

6.1. Do you have cultivated land?

1. Yes 0. No

6.2. If your answer for number 9.1 is yes, how many hectares do you have?_____

6.3. Crop income from rain fed farm land in 2003/2004 e.c agricultural season?

Type of crops	Cultivated Area	Yield in Qt.	Estimated value in birr	Income from crop sale
A. Grain/cereals				
Wheat				
Maize				
Sorghum				
Tefe				
Barley				
Kerkaeata				
Dagusha				
Aeares				
Oil seeds				
Others				
B. Vegetables				
Onions (KeyihShingurti)				
Tomatoes				
Potatoes				
Green pepper				
Tiklilgomen				
Garlic				
Karot				
Keysir				
Duba				
Total				

6.4. Crop income from irrigated land

Type of crops	Cultivated Area	Yield in Qt.	Estimated value in birr	Income from crop sale
C. Grain/cereals				
Wheat				
Maize				
Sorghum				
Tefe				
Barley				
Kerkaeata				
Dagusha				
Aeares				
Oil seeds				
Others				
D. Vegetables				
Onions (KeyihShingurti)				
Tomatoes				
Potatoes				
Green pepper				
Tiklilgomen				
Garlic				
Karot				
Keysir				
Duba				
Total				

PART SEVEN: LIVESTOCK PRODUCTION

7.1. Are you engaged in livestock rearing? 1. Yes 0. No

7.2. What was your income from livestock and its products in 2003/2004 e.c agricultural season?

		Total owned	Estimated Price in birr	Income from sales	Income from rent	Total income
Cattle	Oxen					
	Cows					
	Heifer					
	Bull					
	Calves					
	Total					
Sheep and Goat	Sheep					
	Goat					
	Chicken					
	Total					
Marines	Camel					
	Donkey					
	Mules					
	Horse					
	Total					
Animal product	Milk					
	Cheese					
	Butter					
	Eggs					
	Honey					
Total						

7.3. Miscellaneous categories of income

Item	Income in birr
Agricultural wage	
Non-agricultural wage	
Self-employment in own businesses	
Pensions	
Remittances	
Food for work	
Safety net program	
Others	
Total	

PART EIGHT: HOUSEHOLD FOOD EXPENDITURE

8.1. Cereals

Type of food	Total expenditure on month February			From Agricultural production			From market /bought/			From support		
	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)
Sorghum												
Tefe												
Wheat												
Kerkaeata												
Barley												
Maize												
Rise												
Millet												
Dagusha												
Total cost												

Codes: 1 = for kilogram 2 = for Mlillk 3= for shember

8.2. Oilseeds

Type of food	Total expenditure on month February			From Agricultural production			From market /bought/			From support		
	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)
Beans												
Pea												
Birshen												
Lentils												
Seber												
Sufe												
Adengor/soybean												
Dekoko												
Total cost												

8.3. Vegetables

Type of food	Total expenditure on month February			From Agricultural production			From market /bought/		
	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)
Onions(Keyih Shingurti)									
Tomatoes									
Potatoes									
Tiklilgomen /cabbage/									
Garlic/tseda-shingurti/									
Keysir									
Duba									
Karot									
Total									

8.4. Fruit

Type of food	Total expenditure on month February			From Agricultural production			From market /bought/		
	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)
Zeythun									
Lemon									
Tringo									
Papaya									
Avocado									
Orange									
Total cost									

8.5. Food spice

Type of food	Total expenditure on month February			From Agricultural production			From market /bought/		
	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)
Piper									
Green piper									
Seseg									
Korerima									
Salt									
Zingble									
Tselimkemem									
Total cost									

8.6. Oil, Meat, & other animal products

Type of food	Total expenditure on month February			From Agricultural production			From market /bought/		
	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)	Qut.	Measu.	Price in(br.)
Butter for food									
Butter for hair									
Beef(keftiSiga)									
Chicken (Dero)									
Eggs									
Mutton (nay begiesiga)									
Milk and milk product									
Total cost									

8.7. Drinking and other Expenses

Drinking Expenses		**Other Expenses**	
Type	**Total expenses**	**Type**	**Total expenses**
For local beer (tela)		Honey	
For tej		Sugar	
Alchol		Milk powder	
Beer		Packed foods	
Coffe			
Soft drink			
Total cost		**Total cost**	

PART NINE: NON-FOOD EXPENSES

9.1. Education Expenses		**9.2. Clothe Expenses**	
Type of expenses	**Total expenses for the past six months 2004 e.c**	**Type Expenses**	**Total expenses for the past six months 2004 e.c**
Exercise book and books		Cloth for parents	
Pen and pencils		Cloth for other members of the household	
Transport		Shoe for household	
Uniform for school cloth		Frash	
Other costs		Bed sheet	
		Medical treatment	
Total cost		**Total cost**	

9.1. Sanitary Expenses		**9.2. petrol, wood and light Expenses**	
Type of expenses	**Total expenses for the past six months 2004 e.c**	**Type Expenses**	**Total expenses for the past six months 2004 e.c**
For hair dressing		Insect sides	
For hair cutting		Petroleum	
Soap for cloth cleaning		Matches	
Soap for bath		Candle	
Powder soap/Omo/		Battery	
Cosmetics		For Power	
Perfume			
Total cost		**Total cost**	

9.1. Other Expenses	
Type of expenses	**Total expenses for the past six months 2004 e.c**
Gift for baggers /poor/	
Contribution for societies	
Contribution for association membership	
Gift for church	
Kristina	
Wedding	
Teskar	
Edir	
Total cost	

24. Do you think participating in using seed from SPC is making (will make) a contribution to improvement in your livelihood? Yes= 1, No=0 [if No skip to Q. 26]

25. If yes to Q. 24 in what ways?

_____
_____

26. If No to Q. 24, why not?

_____
_____

27. Which Method of using seed do you think is most promising in your community?

Type: 1. Using seed from your own store

2. Using seed from SPC

3. Using seed from Local Market

4. Using seed from BoARD

28. Why?

_____

PART TEN: Market related variables

10.1. Do you produce wheat crop for market using seed from SPC? (Put √ mark)

1. Yes---------- 2. No----------

10.2. If you don't produce for market, which of the following is important reasons for you? (Put √ mark)

A. The SPC have far distance from home ----------

B. No information about input in the Mekan-SPC ----------

C. No enough market demand for wheat crop ----------

D. Others specify, ----------

10.3. What are the problems in marketing your produce? (Put √ mark)

A. Transportation problem -------- B. Too far from market place ------

C. Low price of agricultural produce------ D. Low bargaining power----------

E. others (specify) ----------

10.4. Where do you sell your farm products? (Put √ mark)

A. On farm (local assembler---------- B. Taking to the local market----------

C. Through service cooperatives -------- D. Other specify----------

10.5. Do you get reasonable price for your produce in 2005? (Put √ mark)

1. Yes---------- 2. No----------

10.6. If no, what are the reasons? (Put √ mark)

1. No demand for the produce----- 2. More supply of the produce------

3. Others (specify)----------

10.7 Does the Mekan-SPC help you to find market for your production?

1. Yes---------- 2. No----------

10.8 Market centers accessible to you

Name of the market	Distance	Mode of transport	Transport cost	Commodities sold at the market place

10.9 What was the average market price of wheat crop last year?

Type of wheat seed	Price at		*To whom you sell at farm gate	*To whom you sell at Market
	Farm gate	Market		
local				
improved				
Others(specify)				

*To whom 1) to whole saller 2) to retailer 3) to direct consumers

10.10. Have you changed to whom you sell in the last 2-3 years? 1=yes 0=No

10.11 if yes, is there change? 1=yes 0=No

10.12. What was the change? _____

10.13. What is the trend in price in the last 3-4 years?

1) Decreasing 2) stagnant 3) increasing

10.14 In that light, how does it compare with alternative crops that you can grow?

10.15 In your view how do you see the selling price of wheat crop?

wheat crop	Price condition					Remarks
	Very Poor(1)	Poor(2)	Moderate	Good(4)	Very good(5)	
Local						
Improved						

10.16 In your view how do you see the prices of inputs used for wheat crop production in relation to the income generated by wheat crop produced/sale?

Inputs	Price condition					Remarks
	Very expensive(1)	Expensive(2)	moderate	Less expensive(4)	Not expensive(5)	
Improved Wheat seed variety						
Fertilizer						
Chemicals						
Labor						
Others (Specify)						

10.17. Do you get market price information on wheat crop?

1) Yes 2) No

10.18 If yes, what are your sources of information and how often do you get access to it?

Sources of information	How often?					Which source you prefer and why?
	Never	Once in a year	Twice in a year	quarterly	weekly	
DA						
Traders						
Mekan-SPC						
Neighbor farmers						
Others(Specify)						

10.19 What do you think are the major marketing problems with regard to improved wheat seed marketing particularly improved variety? ----

---

PART ELEVEN: Sources of agricultural information on wheat crop production for farmers and frequency of contact/ use

11.1 Do you get advisory services from extension agents? 1) Yes 2) No

11.2 How frequently do the extension agents visit you?

0) never 1) Annually 2) Monthly 3) bi-weekly 4) Weekly

11.3) when does extension agent visit you? a) Land preparation b) During input provision c) During sowing d) whenever disease/ pest occur E) during credit collection F) others (Specify)

11.3 Do you visit extension agent? 1) Yes 2) No

11.4 If yes, when do you visit?

1) During sowing for technical advice 2) During input provision to obtain inputs

3) It depends (any time when there is technical problem)

11.5 have you ever get information about using and importance of seed input from Mekan-SPC members?

1) Yes 2) No

11.6 What are your other sources of information and how often you use/ have contact with them?

Other sources	How often you contact/use them					*Means of information exchange
	Never (0)	Once in a year (1)	Monthly (2)	Weekly (3)	Daily (4)	
Researchers						
Contact farmers						
Fellow farmers						
PA leaders						
NGO						
Cooperative(SPC)						
Neighbors/ Friends						
Input dealers						
Agri professio						

*Means of information exchange: 1) Demonstration 2) Field day/visit 3) Training 4) Written materials (leaflets, manuals, and so on) 5) Others (Specify) ----------

11.7 When have you first heard of improved variety of wheat seed selling at Mekan-SPC? _____

11.8From who/ which source? _____

11.9 Which improved variety of wheat crop have you first grown?

1) HAR 1685 2) HAR 2501 3) Digalu 4) pica flower 5) others (specify) _____

11.10 Why did you choose to try this particular variety first? _____

11.11 Which improved varieties of wheat seed you have grown so far and when you have grown them?

Variety	Year first grown	Duration of use	*Reason for stopping using	Variety currently being used
HAR 1685				
HAR 2501				
Digalu				
pica flower				
Others(Specify)				

* Reason for stopping

1) Availability of better variety 2) Unavailability of seeds 3) High seed purchase price

4) Low yield in my field 5) disease and pest problem 6) others (Specify) ----------

11.12 Have you participated in field day/ visit in the last five years? 1) Yes 2) No

11.13 If yes, how many times and who arranged for you?

No of times----------

Who arranged for you? 1) BoARD 2) Research 3) NGO 4) Others (Specify) ----------

11.14 Have you participated in field day/ visit in the last two years organized by Mekan-SPC? 1) Yes 2) No

11.15 If yes, how many times and who arranged for you?

No of times----------

Who arranged for you? 1) BoARD 2) Research 3) NGO 4) Others (Specify) ----------

11.16 Have you ever received training in wheat crop production in the last five years? 1) Yes 0) No

11.17 If yes, how many times and who arranged for you?

No of times----------

Who arranged for you? 1) BoARD 2) Research 3) NGO 4) Others (Specify) ----------

11.18 Have you ever received training in wheat crop production in the last two years organized by Mekan-SPC?

1) Yes 0) No

11.19 If yes, how many times and who arranged for you?

No of times----------

Who arranged for you? 1) BoARD 2) Research 3) NGO 4) Others (Specify) ----------

11.20 Have you hosted demonstration in the last five years? 1) Yes 2) No

11.21 If yes, how many times and with whom you conducted demonstration?

No of times----------

With whom you conducted demonstration? 1) BoARD 2) Research 3) NGO 4) Others

(Specify) ----------

11.22 Have you hosted demonstration in the last two years organized by Mekan-SPC? 1) Yes 2) No

11.23 If yes, how many times and with whom you conducted demonstration?

No of times----------

With whom you conducted demonstration? 1) BoARD 2) Research 3) NGO 4) Others

(Specify) ----------

11.24 Indicate your access to and frequency of use of the following media materials?

Mass media	How often you use them				
	Never(0)	Rarely(1)	Occasionally(2)	Often(3)	Very often(4)
Radio					
Television					
Leaflets					
Pamphlets					
Manuals					
Others					

11.25 Rank your sources of information based on Accessibility, timeliness, reliability of their Information

Sources of information	Rank accessibility	Rank timeliness	Rank reliability	Remark
Extension agent				
Researcher				
NGO				
Contact farmers				
Mass media				
Neighbors/friends				
Input dealers				

PART TWELVE: **Intensity of participation (adoption) in using seed from Mekan-SPC**

12.1 did you encounter disease problem in wheat crop production in 2003/04 E.c production season? 1) Yes 0) No

12.2 If yes, what kind of measure did you take?

1) Local 2) improved 3) Nothing

12.3 If you did not apply improved method of disease control what is your reason? _____

12.4) did you come across weed problem in 2003/04 E.c wheat crop production? 1) Yes 0) No

12.5 If yes, how did you solve this problem? 1) Using chemical 2) hand weeding

12.6 in the last two years production season what kind of wheat seed varieties did you use?

1) Local 2) improved 3) both

12.7) which method of sowing you used in wheat crop production?

1) Spacing 2) Broadcasting 3) Both

12.8 If your answer is spacing, to which variety you used this method?

1) Local 2) improved 3) Both

12.9 did you apply fertilizer in wheat cropproduction? 1) Yes 0) No

12.10 If your answer is yes, to which variety you applied fertilizer?

1) Local 2) improved 3)both

12.11 If your answer is yes, which kind of fertilizer you used? 1) DAP 2) Urea 3) both

12.12 if you did not apply fertilizer in wheat crop production, what is your reason ?

Type of fertilizer not applied yet _____

Reason for not applying _____

PART THIRTEEN: **Knowledge of wheat crop production**

S.No	Practices	Answer boxes	remark
1	Name of the three recommended HYV	1._____ 2._____ 3._____	
2	Give name of any one chemical for wheat crop treatment	1._____	
3	Give the quantity chemical that can be used for /Kgs wheat crop treatment		
4	Seed rate per timad of land for wheat crop production		
5	Recommended fertilizer dose		
	(a) Give the quantity required for Urea for one timad		
	(b) Give the quantity required for Dap for one timad		
6	Give any one herbicide for controlling weed		
	Give the quantity for one timad		
7	Name any one fungicide		
	Give the quantity for one timad		
8	Spacing		
	(a) Row spacing		
	(b) Plant spacing		
9	Give four method that can be used to reduce post harvest loss	1	
		2	
		3	
		4	

PART FOURTEEN: **Perception about the advantage and compatibility of the different components of wheat crop** production **package**

14.1 What is the advantage (superiority) of the following components of using seed input fromMekan-SPC on wheat seed production over the local practices?

Package components	Advantage over the local practices					*Reasons
	Highly inferior(1)	Slightly inferior(2)	equal(3)	Superior(4)	Highly superior(5)	
Improved seed						
Fertilizer						
Chemical						
Weeding						
Inter raw spacing						
Intra raw spacing						
Others						

*** Reasons for less superiority** 1) Not much yield difference 2) Consumes more time 3) Requires more labor 4) Others (Specify) ----------

14.2 How do you see the compatibility of the recommended rate of the using seed input from Mekan-SPC on wheat seed production components with your socio-economic circumstances?

Package components	Compatibility with socio-economic circumstances					*Reasons
	Not compatible(1)	Less compatible(2)	Undecided (3)	Compatible (4)	Highly compatible 5)	
Improved seed						
Fertilizer						
Chemical						
Weeding						
Inter raw spacing						
Intra raw spacing						
Others						

*** Reasons for less compatibility** 1) Financially costly 2) Not better than the local rate/ practices 3) Consumes more time 4) Requires more labor 5) requires more technical knowledge 6) Others (Specify) ---

14.3 Is there price risk in production of wheat crop production? 1) Yes 2) No

14.4 If yes, indicate the degree of risk on the following five point scale

Price risk	Very low(1)	Low(2)	moderate(3)	High(4)	Very high(5)

14.5 is there production risk in wheat crop production? 1. yes 0=no

14.6 Which risk is more significant in wheat crop production? 1) price 2) production

14.7 How do you perceive the investment cost (production cost) of wheat crop production compared to the return or compared to other crop?

Production cost	Very low(1)	Low(2)	Undecided(3))	High(4)	Very high(5)

14.8. Attitudes towards using wheat seed from Mekan-SPC

S.No	Statements	Ratings				
		SA	A	UD	D	SD
1	improved wheat seed practice helps to improve the yield					
2	improved wheat seed practice consumes a lot of labor					
3	improved wheat seed practice demands careful management practices					
4	Unless the package is fully applied, I will not get the expected yield					
5	improved wheat seed practice requires high overhead cost per farmer					
6	improved wheat seed practice is insensitive to local circumstances					
7	Only Small number of farmers benefit from it					
8	Failure in input delivery characterize the package program					

PART FIFTEEN: Variety preference criteria

15.1 Among the inputs available at Mekan-SPC which improved wheat seed variety you prefer and why?

Variety name	Preference rank	*Reason for preference (can be more than one)
HAR 1685		
HAR 2501		
Digalu		
pica flower		
Others(Specify)		

* Preference criteria

1) Grain size 2) Grain color 3) early maturity 4) Market demand 5) Price advantage 6) Storability 7) Yield advantage 8) others _____

15.2 What parameters do you consider important to select among different improved varieties of wheat seed provided by Mekan-SPC? Put them in order of importance.

Parameters	Rank
Yield advantage	
Grain size	
Time of maturity	
Market demand	
Price advantage	
Storability	
Seed production	
Others(specify)	

15.3 Generally what are the major problems in mekan-SPC on supply of improved wheat seed? _____

PART SIXTEEN: **Perception of technology attributes**

14.1 Rate the following if they are advantages of improved variety of wheat seed using from Mekan-SPC?

S.No	List of advantages	Ratings				
		Very low(1)	Low (2)	Medium(3)	High (4)	Veryhigh(5)
1	High productivity/yield advantage					
2	Early maturity					
3	Quality seed					
4	Disease resistance					
5	Insect pest resistance					
6	Resistance to lodging					
7	Long harvest time					
8	World market demand					
9	profitability					

14.2 take five most important advantages of improved wheat seed (using seed from Mekan-SPC) and rank them in order of importance

1st ----------

2nd ----------

3rd ----------

4th ----------

5th ----------

14.3 Rate the following if they are disadvantages of improved variety of wheat seed(using seed from Mekan-SPC)?

S.No	List of advantages	Ratings				
		Very low(1)	Low (2)	Medium(3)	High (4)	Veryhigh(5)
1	Low storability					
2	Regular need for fresh seeds					
3	High seed cost					
4	Seed unavailability (at right time, quality , place and type)					
6	Low market demand					

Checklist used for conducting focused group discussion.

As you probably know, agriculture office is trying to popularize an improved wheat seed, which should significantly increase yields. The office is also providing interested farmers with seed and fertilizers, which are necessary for the cultivation of the improved wheat seed. Even Hiryti-mekan seed producer cooperative also providing wheat seed for farmers. However, most of the farmers are not using it .why?

Why are so few farmers using the new improved wheat seed variety?

Is the improved variety profitable to farmers?

Do the farmers experienced difficulty in procuring the needed inputs? Do they need credit?

What are the general impressions about the improved wheat seed variety?

Do the people like the taste of the new variety of improved wheat seed?

Can you get good quality production inputs of improved wheat seed?

How do you see the recommended seeding and fertilizer application rate?

Did farmers in this area faced disease problem in improved wheat seed production?

Which method of sowing did you use in improved wheat seed production and why?

Which one of the variety (local or improved) you prefer in improved wheat seed cultivation and why?

Annex table1: Adult Equivalence Scales

Years of age	Male	Female
0-1	0.33	0.33
1-2	0.46	0.46
2-3	0.54	0.54
3-5	0.62	0.62
5-7	0.74	0.70
7-10	0.84	0.72
10-12	0.88	0.78
12-14	0.96	0.84
14-16	1.06	0.86
16-18	1.14	0.86
18-30	1.04	0.80
30-60	1.00	0.82
60+	0.84	0.74

Source: Calculated from the World Health Organization (1998) by Stefan Dercon.

Annex table 2: Food item kcal/100 gram Quantity in kg

Food item	Amount	Unit
Teff	1.70	Kg
Barley	4.85	Kg
Wheat	3.15	Kg
Maize	4.48	Kg
Sorghum	2.67	Kg
Horse beans	1.29	Kg
Cow beans	0.23	Kg
Chick peas	0.69	Kg
Milk	0.55	litters
Coffee	0.10	Kg
Sugar	0.10	Kg
Salt	0.70	Kg
Oil	0.15	0.15 litter
Spices	0.25	Birr
Potatoes	1.51	Kg
Enset	0.19	Kg
Onion	0.20	Kg
Cabbage	0.38	Kg

Source: Household Income and Expenditure (1994)

Annex table 3: Quantity of food used for poverty lines per month per person

Food item kcal/100 gram Quantity in kg per month

Food items	**Calories**	**Quantity in kg per month**
wheat	354	6.06
Sorghum	347	3.58
Teff	341	3.21
Barely	354	5.12
Maize	362	4.65
Lentils	370	0.63
Vetch	344	0.41
Soybean	405	0.78
Onion	42	0.57
Tomato	70	0.8
Potato	87	0.14
Cabbage(Tiklilgomen)	25	0.29
Galaric	149	0.48
Piper	318	0.41
Beef	235	0.07
Chicken	140	0.27
Eggs	68	1.54
Coffee	2	0.05
Sugar	400	0.29

Source: computed from own survey, 2012

Annex table 4: Quantity of food used for constructing poverty lines per month per person

Food item	Average consumption per Adult per month per kg food item	Calories value	total calorie per adult * Average consumption per adult per month per kg food item * 10	66000/sum of total calorie per adult * Average consumption per adult per month per kg food item	median price	66000/sum of total calorie per adult * Average consumption per adult per month per kg food item * median price
wheat	5.84	354	20673.6	4.169501756	6.25	26.05938598
Sorghum	3.58	347	12422.6	2.555961693	5	12.77980847
Teff	3.21	341	10946.1	2.291798054	7.75	17.76143492
Barely	4.93	354	17452.2	3.519801996	5.2	18.30297038
Maize	4.65	362	16833	3.319894378	6	19.91936627
Lentils	0.63	370	2331	0.449792142	4.5	2.024064637
Vetch	0.41	344	1410.4	0.29272187	6	1.756331219
Soybean	0.78	405	3159	0.556885509	4.5	2.505984788
Onion	0.57	42	239.4	0.406954795	5	2.034773973
Tomato	0.8	70	560	0.571164624	5	2.855823121
Potato	0.14	87	121.8	0.099953809	5.55	0.554743641
Cabbage (Tiklilgomen)	0.29	25	72.5	0.207047176	4	0.828188705
Galaric	0.48	149	715.2	0.342698774	4	1.370795098
Piper	0.41	318	1303.8	0.29272187	2	0.58544374
Beef	0.07	235	164.5	0.049976905	42	2.099029994
Chicken	0.27	140	378	0.192768061	40	7.710722426
Eggs	1.54	68	1047.2	1.099491901	0.85	0.934568116
Coffee	0.05	2	1	0.035697789	80	2.855823121
Sugar	0.29	400	1160	0.207047176	14.8	3.064298209
	28.94	**4413**	**90991.3**	**20.66188028**		**126.00**

Source: computed from own survey, 2012

Annex table 5 econometric result of using henchman selection model

Heckman selection model -- two-step estimates
(Regression model with sample selection)

Number of obs = 160
Censored obs = 84
Uncensored obs = 76
Wald chi2(13) = 93.42
Prob > chi2 = 0.0000

wheatcropincome_01	**Coef.**	**Std. Err.**	**Z**	**P>|z|**	**[95% Conf. Interval]**
hhage	59.09498	16.72109	3.53	0.011**	26.32225 91.86771
familysize	653.3814	122.3317	5.34	0.000***	413.6156 893.1471
hhsex	-42.24766	182.6872	-0.23	0.817	-400.3081 315.8128
hhfarmsize	1478.697	352.9431	4.19	0.003***	786.9412 2170.453
TLU	538.1823	106.7727	5.04	0.026**	328.9116 747.4529
ownermedia	-20.93434	214.4882	-0.10	0.922	-441.3234 399.4547
irrigation	171.2954	257.2283	0.67	0.505	-332.8629 675.4536
accessmkt	163.0168	246.4498	0.66	0.508	-320.0159 646.0495
socialpart	-110.8782	191.7975	-0.58	0.563	-486.7943 265.038
accesstocredit	-368.3195	240.9378	-1.53	0.126	-840.5489 103.9099
extentionservice	452.5487	193.6642	2.34	0.019**	72.97391 832.1234
partrainning	510.2993	175.5114	2.91	0.004***	166.3033 854.2953
perceptioncoopera	-302.9527	217.5705	-1.39	0.164	-729.383 123.4775
constant	-215.603	618.04	-0.35	0.727	-1426.939 995.7332
treated					
hhage	-.2486704	.0955638	-2.60	0.009***	-.435972 -.0613688
familysize	-.2711313	.3697034	-0.73	0.463	-.9957365 .453474
hhsex	-.304122	.8013747	-0.38	0.704	-1.874788 1.266544
hhfarmsize	-.8003469	1.739101	-0.46	0.645	-4.208922 2.608228
TLU	1.148005	.5796966	1.98	0.048**	.0118209 2.28419
ownermedia	-.1536978	1.164595	-0.13	0.895	-2.436262 2.128866
irrigation	2.648354	.9356541	2.83	0.005***	.8145058 4.482203
accessmkt	-.7965196	1.108515	-0.86	0.392	-2.619554 1.026515
socialpart	1.850226	1.108515	1.67	0.095*	-.3224237 4.022875
accesstocredit	-.7464803	.9016703	-0.83	0.408	-2.513721 1.020761
extentionservice	-1.041489	.8455646	-1.23	0.218	-2.698766 .6157867
partrainning	-1.310813	1.164732	-1.13	0.260	-3.593645 .9720196
perceptioncoopera	.5280512	.7315746	0.72	0.470	-.9058086 1.961911
nearnessSPC	5.560221	1.134031	4.90	0.000***	3.337561 7.782881
constant	6.906269	2.952185	2.34	0.019**	1.120094 12.69244
Mills Lambda	245.2057	121.4247	2.02	0.043**	7.217758 483.1937
Rho	0.55559				
sigma	441.34543				